

THE MONIST

ETHICS, MORALITY, AND METAPHYSICAL ASSUMPTIONS

IF WE START with the supposition that ethics and metaphysics are two distinct sciences, there are four possible relationships which they may have to one another. Either ethics is based on metaphysics, or metaphysics is based on ethics, or they are mutually independent.

It has been the rule, perhaps, rather than the exception, to assume, often without proof, the first relationship, namely, that ethics is based on metaphysics. Ethics becomes a kind of appendage, though an inseparable appendage, to metaphysics; logically and often temporarily posterior to it. Examples of this are to be found in rationalistic systems like Spinoza's, in naturalism, such as Spencer's or Stephen's, or in idealism such as Bradley's. We say "often temporally posterior," because it is not always or necessarily so. Bradley's ethics, for example, were not temporally posterior, but temporally prior to, his metaphysics, but his idea of harmony and individuality demand for their completion, and so really presuppose, his metaphysical absolute Idealism.

The second alternative, the basing of metaphysics on ethics, we shall not be concerned with here, to any extent. Kant is the great classical example of this second alternative, but even Kant, although he asserted the primacy of the practical reason, worked out his enquiry into the nature of metaphysics (which resulted in his denying the possibility of metaphysics) before his ethics proper, and his

stress on the fact that the metaphysical ideas of God, Freedom, Immortality, are simply practical postulates, is an outcome of his examination, his criticism, of metaphysics. If it is not strictly true to say that Kant's metaphysics is prior to his ethics, since he denied metaphysics, it is true to say that his views, properly epistemological, on the possibility and character of metaphysics, are prior both logically and temporally to his ethics.

The most modern attempt definitely to construct metaphysics upon an ethical basis is to be found in Professor Sorley's Gifford Lectures, "Moral Values and the Idea of God."

We shall come to certain conclusions about the third possibility, the mutual dependance of ethics and metaphysics, by an examination later of the first alternative.

The fourth possible alternative mentioned was that metaphysics and ethics should be mutually independent, standing alone as separate sciences. The plea for independent metaphysics is seen in the claim for a more scientific philosophy, rid of ethical prejudice, made by thinkers such as Mr. Bertrand Russell. A philosophy of this kind, and the claim for it, is the outcome of an emphasis on the physical and material rather than on the spiritual problems of the universe. The demand that ethics should be an independent science is also "the prevailing doctrine of the Intuitionist moralists and may be found in the Scholastics before them. Certain ethical propositions—such as those that affirm that justice, veracity, and the common welfare are good—are held to be self-evident, not derived from mathematical, causal, or any other purely theoretical propositions. Ethical truths, and truths of theoretical philosophy will be regarded as arrived at in the same way, . . . but there will be no primacy of one over the other; if metaphysics is not a result of ethics, neither is ethics derived from metaphysics. And this method, as far as

regards ethics, has often been employed by writers like Richard Price, who have not worked out any metaphysical system, as well as by others—Reid, for example—whose ethical doctrine is part of a general philosophical view.”¹ The best modern example of ethics as based on intuitions is perhaps Sidgwick, who holds that “there are certain absolute practical principles, the truth of which, when they are explicitly stated, is manifest.”² Examples of some of these principles are, the Golden Rule, which Sidgwick restates this: “It cannot be right for A to treat B in a manner in which it would be wrong for B to treat A, merely on the ground that they are two different individuals, and without there being any difference in the natures or circumstances of the two which can be stated as a reasonable ground for difference of treatment.”³ The truth of this, he says, “so far as it goes, appears to me self-evident.”⁴ Again, the principle of Rational Self-love or Prudence—that one ought to aim at one’s good on the whole; and the principle that the good of any one individual is of no more importance, from the point of view of the Universe, than the good of any other; are regarded by Sidgwick as ultimate, self-evident; and requiring no metaphysical or other justification. Summing up, Sidgwick says, “The axiom of Prudence, as I have given it, is a self-evident principle, implied in Rational Egoism as commonly accepted. Again, the axiom of Justice or Equity as above stated—‘that similar cases ought to be treated similarly’—belongs in all its applications to Utilitarianism as much as to any system commonly called Intuitive: while the axiom of Rational Benevolence is, in my view, required as a rational basis for the Utilitarian system.”

¹ Sorley, *Moral Values and the Idea of God*, p. 12.

² *Methods of Ethics*, 6th ed., p. 379.

³ Op. cit., p. 380.

⁴ Op. cit., pp. 386-7.

This view, indeed, any view, which regards ethics as independent as based on intuitions, we must reject in the last instance as dogmatic. Maciver,⁵ discussing ethics, which he is here assuming to be an independent study, asks, "Is there a science of ethics? If we turn to the authoritative works on ethics we find they are devoted primarily to the question, what is the supreme good or the supreme good for man? . . . But we discover soon enough that there is no body of accepted doctrine in respect to that problem, and that in the nature of the case there can be none. For if I say . . . that what man *ought* to seek is happiness, how can that statement be controverted except by an equally dogmatic statement that they *ought not* to seek it . . . ethics is . . . concerned with the question of *ought*, the question of right and wrong, good and bad. It is concerned, that is, with a question lying beyond the bounds of scientific procedure, beyond verification, beyond induction, beyond actuality. . . . All ethical claims are claims of worthfulness, and we can neither confirm nor refute them save by our own estimate of their worth." And this is true, most certainly, if we accept the veiled assumption that ethics is an independent study. Only our whole contention will be that it need not be, and indeed must not be, so regarded, that judgments of worth or value must be tested for their truth, just like any other kind of judgment, by their coherence or consistency with the whole scheme of knowledge regarding nature, man, and his place in the cosmos. We may hold certain intuitive beliefs about values, but if these beliefs cannot be supported by cold clear reason, bringing to them everything relevant from science and other knowledge, then we have no right at least to base a *theory* of ethics upon them, however valuable they may be in the guidance of our practical life.

⁵ *Community, a Sociological Study*, pp. 52 and 53.

The attempt, then, to work out a moral scheme for man, apart from any consideration of his origin, his psychological nature, his relation to his environment—and therefore, to some extent the general nature of his environment—seems to us to narrow, quite unreasonably, the sphere of morals, and indeed to render any worthy answer to its questions impossible. To rest ethics upon an intuition unsupported by grounds of reasonable knowledge, is to render it subjective and limited to the beliefs of a particular time, place, society, or even individual. The test must, in the first place, be one of consistency, and in the second place, it must be cosmic rather than local, eternal rather than merely temporal. Man in his deepest nature is an active member in this wider polity of the cosmos, and it is in the demands and experiences of his deepest nature that we must seek for ethical principles. Man regarded thus, as on the rim of the vast cosmic whirl, may appear a little, a solitary, perhaps a lonely spectacle; but this solitariness, this aloneness, even this loneliness, of man, is as ultimate a fact of his nature (a fact too often forgotten when his sociality is stressed), as is his dependence for his very self upon his fellowmen. Man has desires, though too often he does not know it, that cannot be satisfied except in this aloneness with the infinite, when his spirit is filled with what the religious call religion and the holy-minded call worship. Ethical systems hitherto have been based almost solely upon the fact of man's community with his fellows: the idea which we shall here attempt to work out will emphasize, though it must never, never, emphasize exclusively, the fact of man's solitary relationship with the wider cosmic whole. In the very realization of this wider relationship is to be found, we believe, the key to the nature of goodness, whereby can be unlocked the doors of these problems of man's no less important relationships with his fellows. And in so far as discussion of man's place in the

cosmos involves questions as to the ultimate nature of the cosmos, so far it will be necessary to make, dogmatically perhaps (since this cannot be a metaphysical essay as well), one or two assumptions about the general nature of reality.

There are certain problems surrounding the relationship of ethics to metaphysics, which require, perhaps, a preliminary treatment. One of the most usual objections to the view that ethics must be based upon metaphysics, is that the "ought" can never be based upon the "is" because there can in the nature of things be no passage between the two. And in a sense this is true. From the "is" as such, it is not possible to deduce the "ought," if "ought" implies a standard above that which is. But as soon as we examine it we see that this is true only in the narrowest possible sense, in so narrow a sense indeed, that it is nothing more than tautology. If the "ought" and the "is" are defined negatively in terms of one another (i. e., "ought" = something which (at least) *is not*, and "is" = something which (at least) *is not "ought"*) then by definition it is impossible to find the positive meaning of one in terms of the other. But there is, in fact, a sense in which the "ought" can be discovered in the "is," and that is, when what ought to be does actually exist. Aristotle, for example, took as his standard of what *ought* to be the actual choice of the morally wise man. So, although in the very narrow, logical, even tautological, sense we have mentioned above, it may be true that if I *am* just in a particular case there is no meaning in telling me that I ought to be just in that particular case, yet it is in a broader sense palpably true that if one ought to be just in such and such a particular way, and I am just in such and such a particular way, then in that case at least the "ought" has become "is."

It is indeed the "ought" in the larger sense of the moral ideal as a whole, that philosophers have alluded to, when they have said that it is not derivable from what is. But

if it is in no sense derivable from what is, how is it possible to justify its claims in the scheme of knowledge, how is it possible to assert it otherwise than, as we said, dogmatically? Further, how can it be given any *content* at all, if we are not allowed to derive its content from what is? Or, what is the same thing from a slightly different point of view, how can the moral ideal which is in no sense and in no degree realized, have any meaning? It may be a fact that moral ideals, what ought to be, are never fully realized, never, in the full sense, actually *are*. So it may not be possible to discover the ideal as an actual existent *fact* in what is. But what ethics is concerned with mainly, is, not the discovery of a fact, as such, but a **value which is** a standard by which oughts may be measured. And there is no inherent impossibility, we believe, in the finding of real values, and more especially the direction in which real values lie, in reality as it actually exists.

But the view that the problem of the relation of ethics to metaphysics is the problem of the relation of "ought" to "is," is indeed a somewhat narrow one. In reality the question is much bigger, as we hinted in our last paragraph. It is the question of the relation between judgments of value and judgments of fact. A judgment of value need not be in the form of "ought," indeed in so, and directly, it cannot be in the form of "ought." Judgments which contain "ought" are really dependent upon judgments of value which do not contain "ought" themselves. "This is good, therefore I *ought* to strive to attain it." Here the second clause is directly dependent upon the first. And the first, notice, is a judgment of fact of a particular kind (justifiable, often, in terms of a wider realm of fact), "this is (as a matter of fact) good. . . . A judgment of value may then, clearly enough, be a judgment of fact, and vice versa. There is no unbridgeable gap between them, as is often supposed. The reason why there is so often sup-

posed to be such a gap, is, we think, just because the relationship between fact and value is confused with that between "is" and "ought," in the narrow sense alluded to on page 6. If "is" and "ought" are defined negatively in terms of one another, then it follows by definition that "ought" can never be discovered in what is, just because "ought" is (explicitly or implicitly) defined as something which *is not*. And the supposition that an absolute "ought" can never in *any* degree be or exist, the supposition which seems to make it imperative for some moralists to say that "ought" should be defined as (at least) what is not, seems to be grounded in a frantic conviction that if we ever admit that the "ought" or ideal is in any degree attainable, we have destroyed completely its ideal nature. So we must preserve, like Moses, the bounds of the moral Sinai, lest the people, breaking through to gaze, should perish.

The gap which exists as a matter of fact between what is and what ought to be is not for a moment to be denied, of course. We are only maintaining that it is a relative and not an absolute one, and further that the existence of this gap is no warrant for any assertion that there is a gap necessarily existing between any given fact and any given value. A value may be a fact, and vice versa, as we saw. It is indeed the task of the moral life to make values into facts, and for the individual it is essential that he should be conscious of the gap which lies between the fact of his life and the further values which he desires to realize in himself. It is because the desirable thing is just beyond our present reach that we must strive to bridge the gap by our efforts. What ought to be and what is, value and fact, are in this sense, and only in this sense, separated from one another. But the very fact of the moral life is a witness to their constant abridgement by human effort, and although the abstract Ought (with a capital letter) may theoretically never become *is*, or moral effort would

cease, yet the concrete, particular ought is always and continuously being brought into existence.

We have been concerned in the preceding paragraphs with showing that within the strictly moral sphere, fact and value are not necessarily opposed, that even "ought" and "is" themselves are not necessarily opposed, unless we define them in a narrow and restricted way. We have established, with some trouble, what is perhaps an obvious fact when it is once reflected upon. It has been necessary to establish this fact because of the undue stress laid in ethical text books upon the opposition between what is and what ought to be, which is usually assumed to be parallel to the distinction between a natural and a normative science.

But in confining our issue to a somewhat narrowly moral example, we have not yet really faced the fundamental difficulty which besets the problem of the relation between ethics and metaphysics. That difficulty is, not, can values be facts? or, can the "ought" exist as a matter of fact? but, can we pass from a non-ethical proposition to an ethical one? If we can, then, says the argument, ethics is derivable from metaphysics; if we cannot, then it is not, and the ground of ethics must be found elsewhere, presumably in some sort of intuition.

There is a supposition in the assumed antithesis between ethics and metaphysics which requires careful examination. The supposition is simply that, while ethics has to do with ethical propositions, metaphysics is thought to be concerned with non-ethical ones. And the question arises, is it a valid assumption? May not our third alternative stated in the first paragraph, be truer? May not ethics and metaphysics overlap, and so be mutually dependent? Is the subject matter of metaphysics definitely and necessarily non-ethical, in the sense of excluding judgments of moral value?

To say that it is, seems, at first, anyhow, to imply an unnecessarily narrow view of the scope of metaphysics. If metaphysics means what Descartes, for instance, thought it to mean, or if it means what can be proved by the empirical methods of natural science, then it is perhaps true, that from this brand of metaphysics, there can be obtained no judgments of value. If metaphysics is so defined (implicitly or explicitly) that it excludes judgments of value, then of course it follows by definition that no ethical results can follow therefrom. Ethical text books are right when they oppose ethics to the natural sciences, for from these as such can be derived no ethical propositions. But metaphysics, though it may deal with, and be influenced by, truths which it is the business of the scientist to discover, is certainly very much more than a summation of their truths. It is, rather, being the attempt to understand *experience* as a whole, in itself a valuation of the truths of science. In setting them in their place in the cosmic scheme, it cannot avoid interpreting them according to some principle of value or another, and any such unifying interpretation is in itself a valuation. That is what, in the end, Plato's "Form of the Good" meant. It is then not merely that we must take into account in our metaphysics what are usually called moral values, in the sense of values relating to human conduct. We must in addition pronounce judgments of value in terms of some dominating value upon facts and truths which are in themselves non-ethical.

But the question still remains unanswered. Admitting that metaphysics must include strictly moral facts in its survey, and that it must arrange truths under some dominating conception of value, is it true that this value is of an *ethical* kind? The answer to such a question would of course depend upon the type of metaphysics which is assumed. Certain theologies, for example, have conceived

of the universe in a strictly moral or ethical sense, "moral" and "ethical" being taken here in their etymological meaning, as related to human custom and tradition and conduct. The orthodox Christian theory of the Atonement is an instance. It is based upon a notion of justice or requital more or less savage (according to the way in which it is interpreted) which is grounded quite definitely in a pre-Christian morality which had its salvation in the blood of goats, and which however it is interpreted is never less than crudely "moral" in a definitely anthropomorphic sense.

This is an extreme example, and it may be maintained that it is possible to explain the universe in strictly moral terms without falling into the nets of anthropomorphism. Perhaps it is so, and our disagreement with such a view may in the end turn out to be a matter of terminology. It seems to us, however (and it is a strong thing to say), that the terms "moral" and "ethical" can never, without distortion be made large enough to include the universe, or to be made its supreme predicate, although interpreted in a large sense they may well be one of several fundamental predicates. The terms "morality" and "ethics" can never wholly escape from their own etymological significance, and even if they could, it still remains true that morality is *not* the whole of man's nature, though everything he does or thinks or feels is capable of moral valuation. And a metaphysics, to be true, must, as Mr. Bradley has said, satisfy *all* sides of our nature. Our own view is that the aesthetic side of our nature has received too little consideration from metaphysics. A complete view of the world must indeed give complete justice to the fundamental values, beauty and truth as well as goodness.

It is not our purpose here to construct or defend any such complete view of the world. We must return to our original question—as to whether the subject matter of

metaphysics is definitely and necessarily non-ethical—answer it, and so see more clearly the relation of ethics to metaphysics, and from that proceed to examine the general nature of the effect upon the moral life of a definite view of, and attitude towards, reality. The meaning of this very abstract programme will perhaps grow clearer as we proceed.

Our answer to the question as to whether the subject matter of metaphysics is ethical, depended, we saw, on the way in which it was taken. Metaphysics must, being an account of experience in general, take into account the facts of moral as well as other kinds of experience, and it must be a valuation of the facts of experience. On the other hand, although metaphysics is a valuation, we found we could not hold it to be a moral valuation, in the strict sense of "moral," because that tended to involve an anthropomorphic view of the universe. And now, as we have accepted provisionally the view that ethics must be grounded in metaphysics (the grounding of metaphysics in ethics can only mean that metaphysics must take account of ethical values), we have to face the problem of how ethics, the science of moral value, can be related to metaphysics, which uses some other conception of value, which we decided at least could not, strictly speaking, be called moral. Can the moral judgment, "to do this is good" be shown to be true or false by reference not merely to the realm of morals itself, but by a reference to the nature of the larger cosmic reality of which man is a member as truly as he is a member of the community of men, and by reference to man's place and function in that larger community? Is moral good explainable in terms of a wider value which cannot itself be called "good" in the same sense? If it can, then ethics will be based on metaphysics which is not itself strictly ethical (though it must include and therefore be

profoundly influenced by ethical facts). A transition will be possible from the one science to the other.

As it is the practical aspect of the relationship which concerns us here, it will make the problem clearer if we approach it from that point of view. We shall not give any reasoned account of our view of the kind of metaphysic upon which ethics may be based, or study their theoretical relationships, but shall examine the practical effects which follow from a certain definite attitude to the universe, an attitude which no doubt does involve very far reaching metaphysical assumptions and consequences which it is impossible here to elaborate.

The problem is then now, not so much, "is moral good explainable in terms of some other kind of wider value?" as, "is my conduct affected morally, for good or ill, by my attitude towards the wider objective world, and if so, how?" and, "what is the nature of my attitude, and what assumptions does it involve?"

Taking these questions in reverse order and answering them boldly and in loose fashion, we may say, firstly, that we presuppose that the universe is at least a **good universe**; secondly, that a man's attitude towards, or relationships with, a universe which he presupposes, and finds by experience, to be good, can involve a definite emotional tone, to be described; and thirdly, that this attitude or relationship having emotional tone can so affect character that conduct is influenced, and made morally good, thereby. In a word, and still more loosely, it is the emotion which we experience when we perceive, sometimes in a flash, universal good in and through the objects (or persons) of our experience, which is the inspiration of the good life. This is necessarily vague, and in some measure incorrectly stated. It is impossible within the scope of this article to justify it fully. For the present, let us examine certain difficulties which appear on the surface.

In the first place, we have used the forbidden term "good" of the universe. Our excuse is lack for the present of a better word. In order to understand what we do mean by it, we must consider the kind of experience which we have when we make such a judgment as "it's a good world." For it is with an experience, and not with the validity of metaphysical judgments that we are now concerned. We are not referring to the sense of mere physical well-being which a man has, for example, after a comfortable meal, in a deep armchair before a warm fire with a glowing pipe, nor even such exhilaration as we suppose even the old must feel on a morning in the first springtime. These kinds of experiences do often give rise to utterance of optimistic judgments, but it is something bigger and deeper than this to which we refer. The experience may dawn slowly upon us when in contemplative vein, or it may flash suddenly like a divine light upon some incident, person, or thing which before had seemed trifling, even worthless. It is a glimpse of the universal through the particular, it is what men of religion have described as a vision of the ineffable in things of sense, and indeed it is religious experience of a kind, though it does not necessarily involve any formal theological creeds. It may be aroused by contact with natural objects, by intercourse with fellow human beings, humble or great, by joy in work, by creation, by discovery, and by adventure, by things of the mind or things of the body, by painting, music, poetry, or any of the arts, by, in fact, any human experience whatsoever, short of what is gross or hideous or immoral. It is a common experience of souls we are wont to call great, of those who have vision to see the universal spirit in little particular things, of men who are able to discern the true value of life and reality, who could say, like Jesus to his unseeing followers, "Suffer little children, and forbid them not to come unto me: for of such is the kingdom of

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heaven," or, "Consider the lilies of the field how they grow; they toil not, neither do they spin: and yet I say unto you, that even Solomon in all his glory was not arrayed like one of these." It is the common experience of great men, but it is not their monopoly; and neither do they have these experiences because they are great first. Rather do they become great and greater because of the greatness which they are continually able to see in everyday things. And it is that vision which prompts them, and us through their influence, to exclaim, "it is a good world."

The goodness we may thus predicate cannot justly be called moral goodness, neither is it exactly beauty, even though it may be revealed both in human moral goodness and in the contemplation of beauty in art or nature. It seems to be simply intrinsic value itself, and indescribable in terms of any other particular kind of value. And yet on the other hand, it appears to partake both of the nature of goodness and of beauty. "Our appreciation of a beautiful sunset," says Professor Sorley,⁶ "differs from our appreciation of a good deed or a good character. The former is admiration simply, the latter approval." And later,⁷ "We do not speak of a sunset as good instead of beautiful, or, if we do, we recognize that we are not using the word 'good' in its ethical meaning. It is more common to apply the word 'good' to the work of human art, and still more common to apply it to the artist . . . moral approval is something superadded to aesthetic appreciation and not identical with it." It may be, therefore, when we say, "it is a good world," that there is a blending of two different kinds of judgment, one aesthetic, the other moral, either of which can predominate, according to circumstances. We may, even in contemplating nature, for example, experience a wave of sympathy with something definitely spiritual

⁶ Op.cit., p. 32.

⁷ Op. cit., p. 33.

which seems to reside there. There is a feeling of harmonious unity within ourselves due to the fact that we are "at one with nature" which is outside ourselves. In certain moods, and with certain types of mind, this attitude may become definitely religious; we may adore reverently, we may feel gratitude to a Person for the joy that is, not merely given to us from without, but which comes from a Being greater than, but intimately akin with our inner selves. In these moments we may say, not simply, "it is a good world," but, "God is good" and therefore, "it is good for us to be here." At other times when the vision comes with equal intensity, literally "the light that never was on sea or land," we may be so absorbed in the contemplation of beauty that we have neither ability for words nor need of them. In these moments it is still "good for us to be here," there is still a direct experience of communion with a universal spirit in particular things; but the experience itself is sufficient, and it is only afterwards, if at all, that we may make judgments of goodness or even of beauty. The first, the religious attitude, is one involving a consciousness of distinction of self from a Person, even whilst at one with that Person; in the second, the aesthetic attitude, we seem to be (that is not to say that we *are*; we are only analyzing the felt experience) so absorbed in, so projected into the object which we contemplate, that it is sometimes with a start that the spirit, after such an experience, realizes that it is, after all, attached to a physical body. Aesthetic contemplation in itself involves no desire to think or act in any way, though it may give rise afterwards to speculation about its meaning or to deep desires for artistic creation. The self-conscious religious attitude to a Being who is thought of as good in one in which it is easier to define the sort of value which is predicated, than the aesthetic attitude in which *per se* no predication is involved at all. If the aesthetic

experience simply died with itself, as it were, it would not even result in judgments and we could therefore say nothing about the view of the world which it engenders. It is because the man who has the aesthetic experience is also a remembering, thinking, acting being, that we can truly say that the judgment, "it is a good world," is reached through the avenue of the aesthetic experience as well as through the religious or moral one.

The judgment, "it is a good world," would indeed have an entirely different meaning for the man with religious, and the man with aesthetic tendencies, if either of the two were a complete type in himself, or existed in a water-tight compartment. It is because man cannot be solely interested in any one of the three, the good, the beautiful, or the true, that "good" in "it is a good world" cannot be given definitely moral, or aesthetic, or intellectualistic content. The artist (if we take him as representing roughly the man of aesthetic sensibility) may hold no overt religious beliefs, may even be, like Shelley, what is called an atheist, or of what are (again) called "loose morals." He proves, nevertheless, by his actions, that he believes in an ultimate value in reality worth striving to express. Again, the "moral" or religious man may regard definitely ethical or moral qualities as of the most fundamental importance in the universe, and yet he may be more susceptible than he knows to beauty. Most probably it will be to natural beauty that he will turn, since that satisfies his bias toward religion and enables him to think of a "Divine Creator."

We must, in fact, reassert that, if our judgment is to be true when we say, "it is a good world," the term "good" must indeed imply value unqualified; unqualified just because if explored into its depths, it must bring us face to face with any and *all* the values that reside in the universe. "All the great values are cognate with each other,"

says Bosanquet,⁸ "and any of them can be reinforced and vitalized from any other as a point of departure." And each man has his own interests, which to a large extent determine his environment. This environment displays in its character some dominant value, whether intrinsic or instrumental, and it is as a rule this value which seems most important to those who perceive it. To the philosopher it may be truth, to the aesthetic beauty, to the practical moralist goodness. These are intrinsic. To the social worker the most important value may seem temperance, or housing, or sexual morality: to the tradesman it may be honesty or money or leisure; to the public man it may be power, and so on. The dominating object of desire in a man's life is for him the dominating value. But for philosophy it is essential to rid oneself of personal bias, even with regard to the fundamental intrinsic values. "It is a good world," may mean, for me, that the world is good because in men's lives or in nature we see shining a larger, wider goodness, or it may mean that it is good because I experience delight in a labor for truth, or because beauty is there, and beauty seems enough. But for such a judgment to be true in the completest sense, it must hold nothing less than the fullest meaning which is in and beyond all men's minds when they make it.

That is the difficulty inherent in the word "good." "My ways are not your ways, saith the Lord," and finite man the moralist has no right to attribute his little human concepts born of human relationships to the Cosmic Spirit. Moreover, even his finite brother-man the artist would not agree with him. There are three senses in which the term "good" might be used. The first is the sense disputed above, in which it might be used of the world. The second can be predicated of a person, and might be divided into two classes, in one of which it is applied to God, in the

⁸ *Some Suggestions in Ethics*, p. 234.

other to man. The third sense is used of actions which have intrinsic moral value, as when we say, "this is a good action." Some moralists would distinguish a good action from a right one, but we are not at present concerned with this. Now, when we speak of "a good action," or "a good person," if that person be human, the meaning is clear. When applied to God it is only clear if God be represented in some anthropomorphic way, as, for example, a Father. When applied to the universe, it has more or less definite meaning according as the Spirit of the Universe is identified or not with a personal God, but it seems that the more clear and definite the meaning of the word "good" the less true is it to apply it as a general predicate to the universe. Because good in this sense is clearly a value limited and defined in human lives and relationships (it is better that "good" should be taken to mean this) and although *moral* value may be regarded (in some greatly enhanced form) as belonging to the universe or reality as a whole, it would there become transfused with other values equally fundamental, and it would be the fusion of all these values which affects us when we have that vision of the universal through the particular, which we have described. The word "good" is then misleading, and our first conjecture (page 16), that it can be counted as nothing else but simply *value*, is perhaps most true in the end. If we are content to accept that it is in Universal Value (whatever that may mean) that all values meet, that the Universe is one, and that goodness, beauty, and truth, are but aspects of it (though they do not for that reason lose their identity), then we may begin to understand how it is that in a world of all sorts, all sorts and conditions of men may, if they will but gaze outwards from themselves, see Value in the infinite from the side of the finite, and be strengthened thereby in their own finite lives. It is in that sense that the one Value which before we called by the name

"good" may appear to ten thousand men in ten thousand different ways, though mainly by the great avenues, Goodness, Beauty and Truth.

It has not been our purpose, we may once again repeat, to establish one existence of such a value by metaphysical argument, but rather to describe, and without any attempt at psychological precision, the *experience* of it which may give rise to the judgment, whether spoken or implied, that it exists. The experience may come, we have said, mainly in one of three great ways. But whether it comes in the midst of practical life, or through speculation by the intellect, or through contemplation of beautiful objects, it must be something more than merely cognitive. It must be a felt experience, with a definite emotional tone which it is possible to describe.

It is important, then, to realize the significance of the value experience, for it is possible, we think, to base a whole moral theory upon it. Man, we believe, must, as he draws from the external world food and drink for his living body, draw from the cosmic value-experience the dynamic energy of his ever-growing moral life. And we can no more *explain* this moral life without reference to its cosmic environment, than we can form *theories* of physiological processes without reference to substances drawn from the wider realm of physical nature.

Our main metaphysical assumption has been that the Universe has Value which may at certain times be experienced by knowing, feeling, acting man.

It may seem perhaps that our assumption is too large a one to stand without some metaphysical proof, too easily optimistic to be accepted uncritically as the basis of a philosophy of morality. It may be said that we cannot, however we will, avoid considering facts so vital as pain and evil, or to take another aspect of the same thing, we cannot blind ourselves to the apparently non-moral, even the

anti-moral character, of the evolutionary process in nature. Pain has destroyed the moral life as well as made it. Surely if experience is to be the criterion, a pessimistic experience is just as real, just as much a fact as the Value experience which we have made so all important? We cannot here refute such a contention. Our only answer here to such a question would be that although it is possibly true in a sense that a pessimistic outlook on life is as much a fact as an optimistic one, the question arises as to whether it is possible to construct an adequate ethics upon such an experience as its base. If such an ethics could be constructed satisfactorily, then it would be its own justification, and optimism would stand condemned. We are of the opinion that the difficulties in the way of such a pessimistic ethics are insurmountable. As optimism must explain the fact of pessimism (which we think is largely the failure to distinguish between pain and evil) so would pessimism have to explain away the facts of the value experiences.

Even the fact of pain, so poignant in nature, is not, we can here only rather dogmatically assert, a fact that sets us at any real enmity with her. Our combat is but a harnessing of nature's forces to the chariots of the moral life; and the experience of value, even in pain, is the supreme testimony to the triumph of spirit over matter, of mind force over brute force. Once more, then, the felt knowledge, even through pain, that Value is in the world, can be a force revitalizing the whole texture of the moral life, the full realization of the importance of which must certainly, in its turn, most powerfully affect moral theory.

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PERCEPTION AND NATURE

FORMERLY the philosopher's example was the table. One observer viewed it from one angle, another from a different, both at rest relatively, but in different axis systems. The inevitable question, "What is the real table?" followed. There is, of course, an assumption here, namely, that there is a real table, which we shall touch later. As a result of the extension of points of view, such, for example, as those made possible by the reduction of three-fold kinematics to four-fold statics, and dynamics to four dimensional geometry; and because of the "isolation of the epistemological problem," the question of perception and its relation to nature and to natural knowledge is forcibly brought to our attention.

Again, the foundations of geometry were investigated during the nineteenth century from the assumption of points as ultimate given entities in an absolute space. On such assumptions there is nothing more to be done in that field of research. However, on the assumption of relative space or of different space systems an investigation of the foundations of geometry will have to show how space and kinds of space originate from the relations of things given in perception, and what points are. "Thus the starting point for a discussion of the foundations of geometry is a discussion of the immediate data of perception."¹

¹ Whitehead, A. N., *An Enquiry Concerning the Principles of Natural Knowledge*, p. 5.

The physicist has worked on the assumption that an explanation is complete when his subject matter is described in terms of mass, length, and time. His ultimate fact of nature was a distribution of matter in space at an instant of no duration. Such a conception of the ultimate nature of things is unable to account for such facts as momentum and velocity, which are matters of perceptual experience; nor can it account for any other natural facts which involve a space-time process. Processes are inexplicable on such assumptions and processes are facts of perceptual experience. Perception, therefore, becomes a central theme in the physical sciences and in mathematics, especially geometry.

* * *

Science takes its origin very late in the experience of the race, and the foundations of it come to the attention of the individual late in his experience if ever at all. Since this is the case science—the physical sciences are meant—begins with a world of objects partially defined. It does not inquire into the origin of objects as such so long as the purely scientific attitude is maintained, but the aim is to give an adequate description of things that are. What is an “adequate” description is not our purpose here to inquire. What we shall attempt to do is to offer an outline of a theory of perception that is adequate to the physical sciences.

To make a start at all is an assumption, but one must be made somewhere. Our start is with processes. This is not the starting point of the physicist who begins with fixity, i. e., matter spread out in absolute space at a durationless instant, and who is unable, therefore, to account for what is perceived. It occurs to me that, taking what is perceived, namely, processes, as fundamental, it might be shown how what we call “elements” in the process and

the relations that obtain between them are generated from other and earlier processes. For example, it may be that what we speak of as space and time are elements (not simple) that come to be as the result of processes—that space and time, in a significant sense, are ways of description in nature rather than nature as something in space and time to be described. Indeed, it may be that the "I" of perception and the "object" of perception are elements that have been generated from earlier processes. Still further, it is possible that perception is itself a process fundamentally. We shall investigate that view of it.

Before we consider perception as a process it is well to consider processes in general of which perception is a subclass. The following characteristics (or possibly postulates would be better) are fundamental in all processes; (a) All processes may be described in terms of the same kind of terms; (b) All processes involve relata and relations; (c) There is no "simple" process; (d) One process extends over another. We shall discuss each of these briefly.

By (a) is meant that the language of description is the same for all classes of processes. For example, the grammar for so-called mental processes is no different from that which prevails in the description of physical processes. There is no peculiar method which is uniquely applicable to any one field of discourse to the exclusion of all others, but in any description of any process the same method is applicable. Suppose we are making a map of any process. Now such a map is, in the nature of the case, static, fixed, determined, and represents in one aspect a cross-section of the process, or, what the physicist would say, the process at an instant. If the map is complete it represents not only the process at an instant, but the possibility of the process at any instant. At any stage of the process now going on, past, or to come, there will be dis-

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played terms and their relations adequate to the process. Such a map can be constructed for all processes, and the method for constructing them is the same for all.²

(b) It is a description of processes as relata and relations that renders the description adequate. We can not here attempt a discussion of these phenomena but wish only to indicate the sense in which they are employed. Suppose we wish to indicate the position of a point in a plane. By a convenient fiction, such as a system of Cartesian coördinates, this can be done, and we may say that the point is defined by the pair of equations $5x - 4y = 0$, and $3x - 6y = 0$. In such examples it will be seen that the point is itself the cross-section of relations. There is a significant sense in which objects may be defined in terms of relational cross-sections, or, what is more nearly correct, objects *are* such cross-sections. Of the kinds of relations and of the notion of similarity between them we have no intention to discuss, but *assuming* them, we may be certain that a description is adequate when relations and their cross-sections are displayed.

(c) There is no unique process or unit operation in terms of which all others can be described. We may, of course, discuss the dynamics of a particle, and then of a system of particles, using our former discussion as a foundation for the latter; or we may take uniform and multi-form functions in the same manner; or we may take sensory processes as "simples" in psychology and on them build up higher cognitive processes. Any process may be considered simple, but on further investigation it yields its con-

² This statement may appear too general. There are cases in which it will not hold provided certain almost unconscious and most "natural" assumptions are made. Since a map involves spatial connotations, it is easy to see that such a map could not be made for many processes. On the assumption of Euclidean space, for example, it is not possible to interpret certain arithmetical facts. It should be recognized that many of our "unsolvable" problems are such because of the assumptions which lie behind the statement of them. When we say a problem cannot be solved we mean that on the assumptions and with the method at our disposal a solution can not be made.

stituents. Simplicity is largely a matter of the purposes of the investigator.

If there were a unit process all phenomena, all the furniture of earth, heaven, and hell could be derived from it, given a sufficient technique. The universe would then be a universe; but in the present state of nature there are many unit processes which means there is no simple process. How these various unit processes are inter-related is one of the leading problems of philosophy; how they are discovered and the principle or principles upon which they are divided is the business of logic; and once the divisions are made (if it can be done) the investigator has the task of exploiting the subject matter of his field.

It may be impossible for logic to accomplish such a task as the one here suggested. It is certain that such a division as that proposed by John Stuart Mill, for example, leads to confusion. It may be that such a logical process of division and especially the search for principles of division involve circles; but circles do not seem as formidable as they once did. If all reasoning is circular, except as we define it otherwise, which can be done by taking a few terms as undefined and a few propositions as primitive, it is a weak charge against a bit of reasoning to assert it to be circular.

If all processes can be described in terms of the same kind of terms, does it not follow that there is a "simple" process? It is a cheap answer to say that the description of a process is not the process described. This may be true in some cases, but if the description is adequate there is a similarity between the two. There are cases, however, in which the description is the process, and the relation of similarity is then said to be "complete." Description is a technique, and what is meant by the statement that all processes may be described in terms of the same kind of terms is that the same technique is applicable to different

processes and not that since the technique is the same all processes may, therefore, be reducible to one simple process. Man is in possession of a method, more or less effective, for dealing with his world and this method is description (used in a wide sense). Description takes forms, is less accurate in some fields than in others, but in all fields the aim is the same, namely, to describe the facts of perception.

(d) The characteristic of processes by virtue of which they extend over each other is closely connected with that discussed in (c). The expression "extending over" is somewhat figurative, suggesting space and time, but these systems of order should be avoided at this point. They appear later as a resultant of the perceptual fact that one process extends over another, but our methods of description suggest the opposite view. It is this latter view that characterizes Newtonian mechanics, giving origin to absolute time which flows evenly on, and to the Kantian doctrine of the *a priori* nature of space and time. The notion that processes are the fundamental fact of nature demands that space and time be derived from them.

If processes are fundamental it would be strange if perception should be something else. It is not at all strange to believe that processes are given in perception, but it is not ordinary by any means to treat perception itself as another process. But a belief in the fundamentality of processes renders it difficult logically to stop short of this position. I am not saying that there are not certain invariants in processes, but perception certainly is not one of them.

The usual method of stating the problems of perception is such as to bring to the front the knower and the known, and the concomitant problem of primary and secondary qualities. A theory of perception which relegates a part of the world to mind and another part to nature fails,

it seems to me, to make any advance towards the solution of problems that have been in the philosophic atmosphere from the time of Descartes and Locke to our own time. Primary and secondary qualities are in the same boat. I believe the problem of perceptual errors and illusions, and the questions of primary and secondary qualities have been stated, and solutions of them given, in terms of a preconception of the relation between a knower and the known, *i. e.*, from a false emphasis on one or the other of the elements (or functions) in the perceptual process, issuing in answers analogous to that given to such a question as, "Why does a ball dropped from the front of a moving train reach the ground nearer the rear end of the train?"

It is true that the prevailing conceptions in any field determine the problems that can be solved as well as the method in which the problems are stated. If, for example, space is Euclidean is true, then the problems that can be stated and solved are predetermined; if imaginary numbers are not numbers is true, then it is useless to attempt a geometrical representation of the same; if disease is a matter of the possession of devils is true, medical technique is predetermined; if there is ether with certain characteristics, then the Fitzgerald equations have a place in nature. It seems that the statement of the perceptual problem and the solutions offered are no exceptions to this tendency.

Let us begin with perception as a process. By this is not meant what is commonly thought of as, "what is going on in the head." What is meant is that there is an event in nature which may be characterized as perceptual in the same way as when we speak of another event as political, or physical, or social.

There are at least three factors that enter into the determination of the kinds of process, namely, the terms, the resultant of the operations in the process, and the relations that obtain therein. It will be observed that terms

and relations are together. That is, terms imply relations and relations imply terms. It is possible, as suggested above, to reduce terms to the language of relations, but when this is done a relation is substituted for the original one, but the substituted one wears the garb of relations. We must possess these "solid" aspects of experience regardless of the garb they mask in.

It may appear that the whole "process" theory begs the question when it is asserted that the kind of objects (terms) which enter the process determine in part the kind of process. What is desired, it will be said, is a statement of processes which will determine the kind of object, and not, in advance, so to speak, a known kind of object which determines in part the kind of process. The difficulty in setting up such a statement is that in any reasoning process something is assumed, and all that can be expected of any theory is that it will find a place ultimately for the assumptions, *i. e.*, that they *yield*, as well as for the "facts" which it attempts to describe. It can be shown that objects actually are generated out of processes, but to describe the original process adequately requires the use of the very objects which issue from the process in question. Negative and imaginary numbers, for example, have been born out of operations on the fundamental operation of pure mathematics, namely, addition; but to describe adequately the operation of addition involves such a statement as would bring to light negative and imaginary numbers. No statement of the nature of addition is complete which does not make possible all the objects which may be generated out of it, and to render such a statement possible it is essential that the objects generated be known.

Given x , y , z as terms in any process our problem is to determine as far as is possible by a consideration of terms alone, how processes are differentiated when constants are substituted for variables. The first point that

claims attention is that any process yields to schematization in some form as in the case above, *i. e.*, any process has formal properties. If we substitute for the variables oxygen, nitrogen, and argon there results a process which is characterized as physical; if we substitute length, mass, and time we find processes which issue in the body of knowledge known as classical mechanics; if length, breadth and thickness constitute our constants, and these are defined in certain ways, we have processes which are geometrical. Suppose we substitute for one of our variables a "living organism." The processes which result become more complex—they may be either physical, biological, or psychological. If other "living organisms" are substituted for our other variables complexity increases, so that it is impossible to reach definite ideas by a consideration of constants alone. The belief that constants are the only method by which processes can be differentiated has led to much confusion. This much, it seems, we may say safely from a consideration of terms alone, that such words as "psychological," "perceptual," "physical," etc., are adjectival in nature, names in a qualitative sense which are applicable to processes which are in reality the noun. From this standpoint perception is adjectival, descriptive of terms, products, and relations in process. It can be shown, I believe, that this method is applicable to the whole region of psychology, *i. e.*, that "consciousness," the science of which the psychologist claims as his field, is not one of what I have spoken of as the "solid" portions of processes, but is an adjective descriptive of relations, terms, and products in processes.

It is not practicable further to attempt to differentiate processes from terms alone. Indeed, not a great deal can be accomplished by this method alone—by the method of examining the terms only. For example, it is not possible to define order by considering the set of terms to be

ordered, for any given set of terms have many orders. The notion of order must be derived from the relations that obtain among the members of the set of terms.

In the same manner it is not possible to exhaust the details of any process by an examination of the objects that enter into it. There are factors in the process which escape description on the traditional methods of reasoning which confine valid logical operations to the forms of syllogism.

The most fundamental relation involved in the perceptual process is that of asymmetry. This is a relation which implies diversity, yet all diversity does not imply an asymmetrical relation. For example, *a* is different from *b* and *b* is different from *a*, yet this is a symmetrical relation; but *a* can not be greater than *b* and *b* be greater than *a*. It is out of such a relation as asymmetry that series are generated, though not wholly. The terms in such a relational complex are different, and can never be identified, *i. e.*, rendered identical. A common predicate can never be applied in case one should desire to substitute for relational propositions the substance-attribute type, the type common in Aristotelian logic.

The perceptual process involves another kind of relation which has been called "aliorelative."³ This means a relation such that no term has the relation in question to itself. The importance of these relational aspects will be indicated presently.

Of the perceptual process analyzed into terms and relations which are found therein, we may say of the latter, using such descriptive functions as are common to the logic of relations, that the *domain* of the relation is any other process; the *converse domain* is the original process which we have characterized as "perceptual"; and the

³ Russell, Bertrand, *Introduction to Mathematical Philosophy*, p. 32. See Chapters IV-VI for a brief treatment of relations.

field is both the domain and the converse domain, *i. e.*, all the subject matter of natural knowledge.

We may further say that the relational aspects of the perceptual process are one-many. This, however, is a weak differentia for all relations may be replaced by one-many relations. Such relations are descriptions, and it was with this fact in mind that the statement was made earlier that all processes could be described in terms of the same kind of terms. A term in such a complex in which the relation is, is described by the relation, *i. e.*, asylogistically and not by the possession of qualities of any kind, not by the subject-predicate relation. For example, the discoverer of the doctrine of general relativity is described by that relation, and no other term (individual) has precisely the relation, the *r* of *x*. The observer of this process (*this* meaning any process) is likewise described by the relation. But there may be *many* observers of this process, it may be said. Everyday language permits such statements but they are vague. The "many observers of the process" yield to *a*, *b*, *c*, *d*, each of which defined by the relation *r* to *w*, *x*, *y*, *z*.

One of Eddington's dramatic examples* will illustrate the meaning here. The aviator who is moving past us at the rate of 161,000 miles a second believes that our cigar which we light at the same instant he lights his, lasts twice as long as his own; and we believe his lasts twice as long as ours. This is the case because he, in uniform rectilinear motion, believes himself at rest and that we on the earth are passing him at this great speed, while we on earth consider ourselves at rest. The perceptual process here may be analyzed into at least two terms (there may be any number) and the relation "observer." (We make the process as simple as possible for the purpose of the example.) Then each term which may be substituted for the

* Eddington, A. S., *Space, Time, and Gravitation*, p. 23.

first variable in the proposition xry is defined by the relation in question. It is some notion of perception very like this which is adequate for a relativistic physics.

Let us develop briefly the fact that the perceptual process involves an asymmetrical relation. Since such relations imply diversity all doctrines of "the self-identity of subject and object" become meaningless. The reduction of one of the terms in such a relational complex to the other is an impossibility. Such statements, therefore, as "Everything is mental," or "Everything is physical," "All is God, the Absolute," convey no information concerning anything in particular.

If a is the father of b it is not possible to reduce b to a . It may be that b is the father of c but he can not be the father of a . Again, if a is the observer of the process b , then b can not be the observer of a . This statement may be doubted in such a case as the following: a may be the observer of b and b may be the observer of a when both a and b are supplied with reaction machines, such as a nervous system. This difficulty is apparent when it is recognized that we are dealing with more than one process. Then, there is this significant difference that in the relation expressed in " x is the father of y " there is what we may call a "necessary" element which is lacking in the other case. In both cases, properly interpreted, the relation is asymmetrical.

That the perceptual process involves a kind of relation which is termed *aliorelative*, *i. e.*, one such that no term has that relation to itself, is a fact which should drive a great deal of mysticism out of philosophy. Monisms of various kinds would doubtless profit from a consideration of these relations. From the standpoint of perception this relation is significant in that it points to the fact that it is impossible to equate the "knower" and the "known" (to use common terms that should be avoided). Since asymmetri-

cal relations are always aliorelative, what has been said under that heading need not be repeated. The point is that both relations imply diversity.

Processes involve products. There is always something produced, the minimum being the ideal course which is carved out by the process in its actual going-on; the maximum, the elaborate institutions of science, religion, politics, and philosophy.

A scientific psychology, *i. e.*, a quantitative psychology, has as yet not been completely developed. We are at about the same stage in its development as were the Pythagoreans in the development of numbers. Hence, the difficulty in speaking, from the standpoint of current psychology, with any degree of certainty concerning products which result from perceptual processes. Psychology has not developed a "fundamental" operation, and it knows no "operator" which can generate a set or a group. It speaks of sets and groups, but in the vague language of a science looking for a technique. True, it possesses "sensations" and speaks of other processes in their terms, but it has never been able to tell how other processes issue from them. The conic sections, for example, are produced from the circle by a single operation, but the psychologist has been unable thus far to formulate a statement of a process that results in any analogous set. Psychology has not as yet produced its Sophus Lie.

There may be a reason for this state of affairs, and that reason can not be that the psychologist has not had time to do this work, for "the science of the soul" is pretty old. It may be that he has been too busy investigating the "soul" and the "mind" and has let processes alone.

If such be the case any process *becomes* perceptual when the proper terms and relations are present. Perception, then, is not an "awareness," not something "present to mind, plus meaning," not "the consciousness of

something present to sense," but rather the name of a process involving a peculiar kind of term, a kind that possesses some form of reaction system, and a peculiar kind of relation, namely, asymmetrical and aliorelative. The products that result is a psychology in the sense of that term suggested above in the notion of "consciousness," best expressed today by the term "behavior" though not completely; and the vague region expressed by some such term as "nature" or "natural knowledge" which becomes possible through, and takes its origin from, the perceptual process.

The "facts" of perception must be interpreted in the light of the analysis made above. These facts are such as the perceiver or knower, the object known, the stimulus, the perceiving experience, perceptual errors, and illusions.

The first two of these facts have been shown to be terms in a complex. Difficulties have arisen by an emphasis on terms only, such as lead to subjectivism or materialism. The application of the logic of classes to material that is not exhausted by such an operation leaves a foggy view. These terms are related in a manner which is described as asymmetrical and aliorelative. From such a characterization consequences flow which render some views of the nature of objects and perceiver, which have held prominent places in philosophic literature, meaningless.

A misinterpretation of the nature of perception has led to many strange views concerning the stimulus. The chief of these is the Kantian notion of the "thing-in-itself."⁸ Many of the doctrines that advocate an "unknowable" are bound up with a theory of perception in which is involved in some inexplicable manner the "mind." The stimulus, so it is said, sets in operation a mind, and there result objects of perception and knowledge. The object is cre-

⁸ The "thing-in-itself" of philosophy when translated to physics becomes the "matter" of that science.

ated by the machinery of the mind, and the mind knows its own children. An erroneous view of the stimulus has led to the doctrine that knowledge is a copy of the object, and more indirectly, to the doctrine of primary and secondary qualities.

The stimulus in a perceptual process is not something that awakens a passive mind which in turn stamps its categories on the raw stuff of the senses, but is a term in a complex. However far it may be traced back it can always be described in this manner. Certain wave lengths in certain relations generate sound; others generate light. It is difficult to state this clearly due to our habits of thought about such matters. What is defined as a stimulus in one complex or process may be an object or term in another of a different kind. But in all processes involving what we call a stimulus this same stimulus becomes an object in a further perceptual process. That is to say, the stimulus in one of its chief rôles, if not the only one it takes, is what the psychologist speaks of as the "object of perception." Whatever can be treated as a stimulus is capable of treatment as an object in the perceptual process. It takes the same place in the world of nature that any other natural event takes, and instead of being the "unknown cause" of anything whatever, it submits to precisely the same treatment that any natural event takes.

It has been pointed out that there is a process which is "subjective" in nature, and which may be shown by some such diagram as the following: Object——Perceiver. Between the two there is a process of perceiving which is psychological, something "going on in my head." Let us assume that there is such a process which can be stated in some manner such as " x is seeing a tree" when x is not the seeing nor is the tree the seeing. How can a theory of perception as a process absorb such a fact? If the fact is capable of description it takes its place along with any

other of the same kind. That is, it is analogous to the fact that x is hitting a nail or the wind is blowing the leaves. When x describes the experience (process), " x is seeing a tree" he will proceed along the same lines as when z describes the experience of " x seeing a tree." If his description is adequate he will state the terms and relations in the process, for any fact that can be described must be described in the language that gives origin to the logic of classes and of relations, and in no other way.

It has been frequently argued that description of a process is fatal to the process, that science falsifies reality, that analysis gives only static views of processes which are *the* real. Touching our problem of perception it is said that description of it, or of any other "psychical" experience for that matter, falsifies the experience. The description of " x has the toothache" is different from " x has the toothache"—the immediate experience. But the description of " x has the toothache" differs in no essential respect from that of any process in which a constant is substituted for the subject and the predicate respectively of the original proposition. A "psychical" experience is no more falsified by description than any other experience (process). That is to say, there is nothing peculiar to "psychical" experiences which renders a description of them false when description may be true of some other process, such as the falling of a tree. Of course, this does not show that description does not falsify processes, but it indicates that if it falsifies "psychical" processes it also does it to "physical" processes.

We can not here attempt to answer the arguments of the falsifactory nature of description and analysis, but wish to say that there is no legitimate sense in which we may live in a world of "description" and one of "appreciation." The world of "appreciation" may be a little more difficult in yielding to our methods of treatment, but when it does

yield as parts have done from time to time, a new science is born. Indeed, the history of science is the story of how matters of "appreciation" have yielded to description and of how the technique of description has been refined.

Such beliefs (that science falsifies reality) are seen to be unwarranted in view of the fact that what science has to say about an event, process, or object is precisely what the event, process, or object is. If a mistake has been made it is always corrected in terms of another descriptive process, and not along lines which abandon description, unless we become mystics.

Errors and illusions have always been stumbling blocks to otherwise neat and attractive theories. They are usually believed to be "mental"—in some way the "mind distorts the real." It is strange, as has been pointed out by others, that a great many mechanical devices, such as the thermometer and the camera, have this uncanny habit along with the mind. Would it not be better, in all such cases of "distortion," to regard them as brought about by the interaction of various physical things? Every case can be described, and becomes, therefore, a part of the furniture of nature.

The belief that there is a unique *real* object or process, described by a few simple terms and relations has caused much difficulty in dealing with perceptual errors. Just as no set of terms has one order but as many as it is capable of, so is an object (any unit of discourse) not a unique something but everything it is capable of. Almost every day objects (in the sense above) are taking on complexity; new "orders," so to speak, are discovered, and the object is all the "orders" it is capable of. It seems to me that a

thorough recognition of this point will answer the difficulties of variability in perceptual experiences. Error, interpreted in the perceptual sense, is answered in the same manner. Interpreted as "falsehood" as against "truth," questions arise which are not within the province of an outline of a theory of perception.

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A CRITICISM OF CRITICAL REALISM

Critical Realism occupies a half-way house between moderate Realism and moderate Idealism, and it is exposed to the adverse winds that blow from both quarters. It is a well known theory as to the machinery of what is called perception and the nature of the entities experienced in perception, which has been propounded by seven American professors as a counterblast to the six American Neo-Realists.

In theory, Critical Realism is one doctrine to which the seven American professors unanimously subscribe; in fact, it comprises at least two distinct doctrines, each of which contradicts the other. Whether this difference of doctrine has been detected and waived in the interests of unanimity, or whether the desire for unanimity has obscured the perception of difference, cannot be determined here—although the number of foot-notes contained in the volume entitled, *Critical Realism*, purporting to explain or resolve differences which are unimportant, suggests the latter view.

Of these two doctrines, the theories of Professor Drake and Professor Santyana may be taken as representative. I propose to consider these theories in turn, to suggest certain criticisms to which they appear to be open, and to indicate the reasons why it is impossible for a thinker who agrees with Professor Drake to subscribe to the doctrine of Professor Santyana, and vice versa.

According to Professor Drake there are involved in perception three separate existents: (a) the object of perception, (b) the mental state of the conscious organism which perceivies the object, (c) the intermediary processes such as ether waves, sense organs and neural correlates. In addition to these three existents there are also what he calls the data of perception, the entities which are actually perceived. These data are not existents; they are variously called character complexes or essences, and they are brought into being by the coming into contact of (a) the object of perception, and (b) the mental state of the conscious organism. The coming into experience of the datum is explained as follows: contact between (a) and (b) involves the exercise of a certain influence by (a) over (b); this influence is causal, what it causes among other things being—in true perception—the appearance of the characteristics of the object as the data of perception. These data are further described as projections of our mental states; "they are," in Professor Drake's words, "*never found* there by a sort of telepathic vision, but are *imagined* there by a mind," and we are told that there exist in, or in intimate connection with the brain, a series of mental states which have the qualities that make our data appear. Since, however, it was the influence of the particular object (a), and not of any other object, that caused (b) to project the data, the data have a very definite reference to the object in question; and in fact, as has been already remarked, in true perception they *are* the actual characteristics of the object. Thus perception is a process of imagination, since in perception we experience data which the organism, affected by the outer object, "*imagines* as characteristics of the object in those vivid ways we call 'seeing,' 'feeling' (with our fingers), etc." We are also told that though the data may have being or 'subsistence' independently of the perceiver's consciousness of them, they

have not independent existence. We implicitly attribute existence to them when we imagine them as being *out* there in the world, and since in true perception the data or imagined character traits of the object really *are* the characteristics of the object, the attribution of existence is in such a case justified: in false perception it is not, and the data then have being or subsistence only.

Before proceeding to consider the view of Professor Santyana, I propose to submit certain objections to the theory of Professor Drake.

(1) The theory involves a relationship between two entities which exist and one which subsists. The entities which exist are the mental state of the knowing mind and the object: the entity which subsists is the datum or character complex which forms the content of the knowing mind. Now the analysis of perception is such that it requires us to hold that the object is never, and can never under any circumstances, be directly perceived. "Our data of perception," says Professor Drake, "are not actual portions or selected aspects of the objects perceived." But if this is so, in what sense are the objects perceived at all?

The difficulty here is simply the old difficulty that discredited the philosophy of Locke, the "object" of Professor Drake is the "substance" of Locke, and the theory of Professor Drake is the Representationalism of Locke.

For if we never know the object, but only character complexes which we like to think are, in veridical perception, the characteristics of the object, we cannot know anything about the object: we cannot know that the object exists, and we cannot know it is the cause of the occurrence of our data; while the belief that our character complexes sometimes correspond with its characteristics will remain a guess, which we shall regard as probable or improbable in so far as we already share or reject the beliefs of Pro-

fessor Drake, but cannot be cited as evidence of the truth of these beliefs.

(2) From the fact that we never know the characteristics of the alleged object, it follows that we can never know whether our character complexes correspond with them or not: hence we can never know whether our perception is accurate or not, and the Critical Realist criterion between true and false perception can never in practice be applied.

Professor Drake likes to think that perception is in the main accurate, and invokes at the beginning of his essay a number of Pragmatic considerations in favor of believing that it is so. But wishes father thoughts, they do not breed evidence: the fact that we would like a thing to be true does not mean that it is true; while the reference to the Pragmatic criterion as affording a meaning for truth is expressly disavowed by another Critical Realist.

Objections of this and of a similar character are in part considered by Professor Pratt in his essay on the "Possibility of Knowledge," in the course of which he endeavors to answer them. The gist of his reply consists in representing the view of the Critical Realist and that of the complete sceptic as the only possible alternatives, and then dilating upon the improbability of the sceptical view. "If the critic is right," says Professor Pratt, "we must suppose that by an incomprehensible collection of coincidences his own senses, the senses of all other observers, and the details of the prior and subsequent experiences of all concerned conspire to deceive us." But an expression of doubt as to the validity of the Critical Realist position does not surely involve the acceptance of so distressing an alternative. Professor Pratt presents us with a choice between accepting all our perceptions as accurate, or impugning them all as deceptive; but this dichotomy is an unreal one which ignores the real difficulty and the real

question, the difficulty being that in practice we know that our perceptions are neither all true nor all false, but sometimes true and sometimes false, and the question at issue how we are to distinguish the true from the false. It is the first requisite of any theory of perception that it should suggest some method of solving the difficulty involved in the answer to this question, and it is precisely this requisite that both Professors Pratt and Drake fail to supply.

There is, however, another item in Professor Pratt's defence which deserves mention. He appeals, in support of the accuracy of perception, to the uniform character of the testimony of the senses: each sense supports and bears out the other, and in so doing affords evidence of the truth of its testimony. Also there is the appeal to other persons. But here again Professor Pratt fails to appreciate the issue, which is not that of always true perception against always false perception, but between any true perception and any false one: and the trouble is that in a false perception the senses support one another just as frequently as in a true one, as for instance in the perception by a color blind person of a green apple. But in any event the attempt to bolster up the validity of one sense by another when it is the validity of sense perception as a whole which is questioned, will not work. The belief that my sense of sight which informs me that I am writing at a table is guaranteed by my sense of touch which also assures me of the table, is only reasonable if the validity of my sense of touch is established to begin with: but you cannot establish the validity of an A that is fallible, by an appeal to a B, which must itself be assumed to be fallible for just so long as the fallibility of A is itself in question. If A is fallible then it derives no support from an equally fallible B; if A is infallible it does not need it.

Let us suppose, however, that the testimony of our senses is always, and in every respect unanimous, does this

fact necessarily constitute a guarantee of their truth? Coherent error is by no means to be ruled out as a possibility, and is certainly not ruled out by Professor Pratt's analysis. The world of dreams and hallucination is frequently as coherent as that of every day life, and is not necessarily distinguished by contradictory deliverances on the part of the senses. And in any event, so long as the Critical Realist denies us all direct knowledge of the object perceived, the world of every day experience *need* possess no greater degree of connection or correspondence with the world of external reality than the nightmare phantasies of the injudicious diner; it may do of course, but the Critical Realist can neither prove that it must do, nor can he distinguish the occasions on which it does from those on which it does not.

I now proceed to a consideration of Professor Santyana's view, or rather to those aspects of it which differ from Professor Drake's.

The chief point of difference is contained in Professor Santyana's description of the datum. The datum is for him a logical essence, a quality which is permanent and given. It neither lapses nor moves forward, and it is therefore outside the flux of temporal events. We are expressly told that the circumstance that a datum is given is incidental only and does not affect the nature of the datum, from which it follows that the essence is not changed either by becoming a datum or by being abandoned for another. In experiencing a datum we are in fact becoming acquainted with an entity which subsists independently of our acquaintance, an entity which is immutable and eternal, and Professor Santyana proceeds to speak of the "datum" as Plato's $\tau\ddot{o}\ \check{\nu}\tau\omega\varsigma\ \check{\nu}\nu$ or as that which is intrinsic and essential.

The first point to notice about this conception is its wide divergence from that of Professor Drake. For Professor

Drake, as we have seen, the datum is literally a product of our imagination: it is "projected" or "imagined" as being out there. If this is so, it clearly cannot be out there before we projected or imagined it, and the circumstance of its being imagined becomes not an incidental attribute but a most essential fact about its nature, the very cause of its being. In short, the datum for Professor Drake is a mental construction which when we are lucky is identical with the characteristics of the so-called object.

But Professor Santyana's departure from the pure doctrine of Professor Drake raises its own crop of difficulties. In the first place it reduces the occurrence of perception to a mere accident. Thus Professor Santyana speaks of what happens "when our erring thoughts light up the intrinsic possibilities." Now Professor Drake attributed the occurrence of perception or the projection of data, to the emanation from the object of an influence upon the brain of the perceiver. But for Professor Santyana the experiencing of a datum happens by chance. We are not, as we might have been, told that for each object there subsists a corresponding datum or series of data, and that by some queer alchemy an influence exerted by the object makes us perceive not the object but the corresponding datum. Had we been told this, we should have a theory of perception that possessed some relationship with that of Professor Drake; but even so neither Professor Drake nor Professor Santyana could explain how we perceive erroneously. For if the cause, and the only possible cause of the perception of a datum is the influence upon the brain of an object possessing characteristics which are those of the datum perceived, how comes it that in error we perceive data which ex hypothesi are not the characteristics of any object? Whence come these data? What in fact is the starting point of the whole process of erroneous perception? If we conceive of perception with Professor

Drake as the projection of data which are the characteristics of the object, how can we project data which are not? If, on the other hand, we hold with Professor Santyana that the realm of essences is lying out there waiting to become the content of our experience, and that therefore "our object is simply what we happen to think of," we are forced to the conclusion that the objects of all possible perceptions, as for instance the objects of our perception of blue snakes when we are drunk, already subsist in their infinite multiplicity waiting to become our data when we light on them.

But if we are to adopt this latter view, we are faced with a refusal to apply Occam's razor of the most extravagant kind. It is a significant fact that in considering Professor Santyana's view we have necessarily drifted into speaking of the essence or datum as the object, and in so doing we have only followed his own terminology. But what has been happening all this time to the object in Professor Drake's sense of the word, that entity whose characteristics are or are the same as our (in Professor Drake's language) "imagined data"?

Well, it seems that the world is for Professor Santyana as for Professor Drake, peopled with these latter kind of objects, just as for Professor Santyana alone it is also peopled with independent logical essences, the relations between essence and object being such that when we perceive correctly we have hit on an essence that corresponds with the character of the object, when not, not. But what in the name of Occam's razor is the sense of peopling your universe with an infinite number of objects and essences, both of them lying out there, of which the object never can be an object of perception, while the essence always is an object of perception, whenever perception occurs; and both of them of such a nature that when a purely incidental and adventitious phenomenon such as perception, a phenome-

non which is irrelevant to the being of either, takes place and happens also to be correct, the essence is said to have the characters of the object, although since the object can never be perceived, it passes the wit of man to know whether the essence does have those characters or not.

And as a concluding comment on Professor Santyana's view, I should like to ask how it comes about that if essences become objects by accident, we all of us perceive what is approximately the same world. If the essence whose characteristics are those of an alleged object which is a motor car, is perceived by me by accident, and not because a motor car is really there, or is really perceived there, how comes it that an accident of precisely this same kind brings the same set of essences to the notice of my chauffeur at precisely the same time. Does not the repeated sequence of such accidents suggest that the process of perception is not an accident at all, but is dictated by some feature in the real which affects in much the same way, and affects directly the organisms of two similarly constituted persons?

It would be interesting to examine the essays of the other authors of Critical Realism, to see how they oscillate between the two views of the nature of the datum expounded by Professor Drake and Professor Santyana respectively. It would be interesting too to notice how the fact that the word "datum" is normally used in that one of its two senses which happens to be most convenient for the purposes of the argument at the moment, has not a little to do with the persuasiveness of their writing. It is, of course, unfortunate that his method may be inverted; and the critic who with equal authority adopts whichever of the two senses he pleases for the purpose of discrediting the argument, may achieve disastrous results. I will subject to this treatment one sentence from Professor Pratt's essay which typifies the ambiguity that so frequently results. "A sharp distinction must," he says, "be drawn

between object and content, between that which is before the mind and that which is within it." Now the word "object" here may be used either in the sense in which Professor Santyana speaks of the datum or essence as the object or in Professor Drake's sense of the word. If it is intended to refer to the datum according to Professor Santyana's use of the word "object," then we may suggest that as we always project or imagine our own data (Professor Drake), the mind can never contemplate anything but its own mental creations, and we are back on the subjective Idealism of Berkeley. If, on the other hand, "object" here means the real object which exists and not the datum which subsists, then the mental content must be the datum and the datum can be nothing but the mental content. But how can a mental content be a logical essence?

An analysis of Professor Roger's essay on the Problem of Error yields results which are not dissimilar. His theory leaves us with the same difficulties as those we have already experienced, the difficulty, namely, of explaining, (1) how we can ever tell a true perception from a false one, and (2) how an erroneous perception ever occurs. For as we never know the object we can never tell whether it has the qualities of the sense data we imagine, and as our attribution of those same qualities is generated by its influence of the object which is supposed to possess them, it is clear that we can never be stimulated to project or imagine qualities which the object does not possess.

A theory of error which fails to deal satisfactorily with the question of how we distinguish the true from the false, and the problem of the genesis of error, can only be termed inadequate.

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THE SPIRIT OF RESEARCH

I. THE FOUR TYPES OF RESEARCH

IN THE FAR SOUTHWEST lies a valley between two mountain chains. On the eastern side the mountains range from ten thousand feet down. At the north rise rather precipitously from the floor of the valley a number of granite peaks, conspicuous from its whole length. Mountain springs furnish brooks, which slowly vanish as they drop lower and lower down the thirsty canyons. Farther south the eastern wall is harsh and cut by deep erosions as the waters of the summer deluges of the centuries have gnawed away at their steep slopes. Two porphyry peaks rise abruptly, standing like Indian sentinels to warn the valley of approaching danger. Still farther south, the range becomes more massive, rises sharply in ragged pyramids that rest on a broad, sweeping base, where the tall yellow pine grows. At the extreme southern end of the chain the peaks become more rounded and are of quartzite. The chain that bounds the western side of the valley starts at the north in an extensive line of cliffs and jagged edges, granite and quartzite masses. It sinks into a low line of hills, and then rises again abruptly into a wall of upturned quartzite and marble, which the hand of Time has built into castles, towers, and fortifications of exceptional sharpness of outline. Farther south, the chain becomes a series of massive rounded mountains, containing many rich veins of copper ores.

The valley itself is of easy slopes, over which run the flood waters from the bordering walls and their canyons, but no river carries these waters back to the sea, as the valley is greedy for all the water it receives. The slopes are stream-built, and the entire valley is filled for thousands of feet with the débris of ages. A characteristic feature is the presence of many rounded buttes, standing like islands in the middle part, an archipelago of survivors, not yet completely buried, of the original igneous hills. The history starts with the Pre-Cambrian sedimentation, deformation, volcanism, and metamorphism, followed by erosion. In the Paleozoic time, the limestones were formed under the sea, shortly afterward were elevated, and with all the other strata were folded and crumpled like a handful of waste-paper. A dip to the south allowed the sea again to wear away the land for a short time. Since the beginning of the Quarternary period, the valley has filled up with the wash of the torrential rains, the conquests of the fierce charges of the wind, the wave-driven sands of a salt lake, while even underneath, the material has been re-deposited by underground channels.

Growing in isolated patches is the thorny mesquite, in others the cat's-claw, the grease-wood, the sage-brush. All are used to hard conditions, and can survive for many long weeks without water save such as may be in the slight humidity of the air. The ocatilla spreads its slender whips to the sky, tipped with scarlet. The kallstroemia and the evolvulus grow in profuse masses amidst the stretches of gramma grass, sacaton grass, galleta grass. Even on the edges of the alkali lake, lying torpid under the blazing sun, may be found saltbushes, which can exist under most adverse conditions.

In the shadows of the bushes hide the jack-rabbit, the small burrowing animals of the desert, the diamond-backed rattler, and various bronze and silver lizards. The cactus-

wren and song-sparrow flit about in search of food. Over-head wheel buzzards in search of victims of drought and starvation. Tall century-plants spread their honey-laden arms, and many forms of yucca and agave attract birds and insects. Under the stones hide centipedes and scorpions, and in the twilight the skulking shadow of the coyote glides silently through the landscape. In the canyons are forest-trees where the mocking-bird pours out his concert, while the flash of the Baltimore oriole lights the somber green. The crested quail with wary eye for fox and snake guards her young under the live-oaks, and high up in the indigo blue floats a solitary eagle.

In the depths of the mountains the metallurgist finds ores of gold, silver, copper, and lead. The tall smelter stacks evidence the activity due to these. In springs near some of the buttes, sulphur is a constituent, furnishing a name for the valley. The chemist finds in the soil and particularly in the alkali lake the chlorides, sulphates, and carbonates of potassium and sodium, and also salts of calcium and magnesium. The valley is even charted to show the amounts of these in the soil. The rise and fall of the ground-waters is a problem for the physicist. The drifting effect of the wind on the contours is a problem in mechanics. For the biologist there are other problems, for life exists here under hard conditions. Over a tract of fifty square miles there is practically no life at all, and few forms exist in the inhospitable and bitter waters of the lake. The valley is one of the spots where Nature intended to be alone.

This brief sketch indicates what scientific research is interested in when it studies the valley. A complete account would be quite voluminous. But it would not exhaust the description of the valley. There are other types of research as fundamental as that of science. There is for instance the mathematical. The flowing profiles of expo-

nential curves sweep down the stream-built slopes from the mountains. The helicoidal curves of vortices of dust that rise from the valley to the sky every hot summer day, wind their spirals in whirls that widen asymptotically upwards. The shimmering plane of the alkali lake reflects the distant mountain surfaces. These surfaces are bent and twisted like oriental rugs flung carelessly down. Edges of regression of developables, parabolic lines, hyperboloidal passes, pinch-points, conical points, nodal lines, the entire array of the geometry of surfaces, may be found in these deeply eroded, volcanic slopes, and jagged peaks. Fan-shaped draws spread out at the bases of canyons where they discharge their waters, and steep-walled arroyos break the continuity. The lines of level of old ocean shores, and of modern lake beaches can be discerned. In places, the cusps of the drifted sand-dunes limit the curves drawn by the fingers of the wind. In others, the fine dust lies in sweeping transcendental curves with centers, nodes, foci, fauces, lines of divergence or convergence, every type of curvature—evanescent congruences different every hour, yet all subject to the same differential equations. The wind blows and the shimmering lake breaks up into a thousand curved mirrors held by dancing fairies, but the partial differential equations have designed the ballet. The mountains grind the glittering crystals into finer and finer particles, but the dihedral angles are always the same, and under the laws of groups. All the projective geometry of optics may be studied in the valley atmosphere. Vector analysis sees its curl and divergence, vector lines and congruences every day. The algebra, geometry, and analysis of the valley is a wonderful story.

For a different group of investigators the valley does not consist of geological formations, minerals, chemicals, and strange forms of life, nor of twisted lines and crumpled surfaces. They see the valley as the home of the lean,

swarthy Apache. Before long-horned cattle had eaten all the grass, deer lived in the valley; game of many kinds was abundant; the streams furnished enough water for human life; mesquite beans and yucca pods furnished nutriment; the cactus furnished fruit; the maguey, dessert. The cougar and the coyote gave their skins, and birds their feathers. Stones furnished tips for his arrows, the sinews of the deer his cords. He lived continually outdoors, and could travel a hundred miles in a day, with no food, little water, and under a blazing sun, whose blue-white rays scorched his naked body. He climbed to the very tops of the impossible crags, for thence he could see the entire valley. His moccasined feet clung to the most precarious footing, and the grip of his lean hands was steel. When he lay down he melted into the ochre soil as if he could become invisible. He wove baskets from the grasses and other fibres, to hold his scant supplies, to carry water, and for other purposes. He knew the value of all the desert plants. On the mountain tops grew the laurel, whose leaves made men lose their minds. He knew where to find the cat-tail in the cienagas, with its sacred yellow pollen, with which he made his worship of the sun and moon. He carried a little deer-skin bag everywhere to hold this marvelous powder, for performing his rites in hunting, sickness, in spells, and all the affairs of life.

Lean and wiry, a function of the desert and the peak, of the sun and the wind, the lightning and the cloud, tireless, abstemious, leading a life which had little humor or gaiety, facing the stern and pitiless vicissitudes of the valley, he became like the country itself. He had no grudge against the wild growths from which he wrested his sustenance, for he loved this land of burning sun and little rain. To him it was Chiricahua—the Beautiful. In return the land loved him and his grim mother always placed something within reach to maintain life. He lived in small

groups, never in towns or villages, since there was rarely enough in any one place to feed a large village. In consequence, he became solitary, taciturn, hiding his feelings tightly from everybody but the sun and moon, unless in the grip of some terrible calamity he held his spirit-dance to implore the gods for mercy and compassion.

After many centuries came invaders, tanned warriors from the south, with death-dealing fire-arms, mounted on horses, dressed in mail, a motley horde of warriors, adventurers, and priests. Some hunted gold, always chasing the end of the rainbow, some looked for excitement, some for new lands for the king, some to rescue the heathen from everlasting fire, even at the cost of his life. The years flowed along, there came more of the swaggering race, and a fight began for existence on one side and extermination on the other. The Apache began to hunt the Spaniard as he had hunted the deer, the cougar, and the coyote. All his cunning gained a new quality, all his harsh nature became more cruel, all his intelligence began to center on one aim, self-preservation. He knew that his mountain fastness, caves, inaccessible crags, huge boulders, and obliterated trails were his only friends. The prickly cactus, the entangling cat's-claw, terrible cholla, stinging ant, the rattler, the centipede, the dazzling sun and dry water-courses, fought for him. He burned mission churches, slew men, women, and children, tortured to death all captives as a warning to others to stay out. Then came the pale-faced Anglo-Saxon. Although a few desperate struggles insured him the valley for a few years, the game was gone, the old life was impossible, and he was scattered on many reservations. Here he acquired new traits, still a function of his conditions, and his neighbors.

The valley is far from being exhausted, however, and another type of research presents it from a totally different aspect. These investigators are not hunting for the

structures and laws of science or mathematics; nor for the functional inter-relations of a people and its environment. They have in view a more intangible structure, more subtle laws. For them the colors laid on the long wrinkled slopes by the sun and the air, the ethereal ocean in which float the crags and domes, mean more than all the quartzite, porphyry, and granite, or the copper, gold, and silver ledges. The orange and cardinal cups, the little blue stars that shine among the dainty black feathers poised delicately on hair-like stems, mean more than classifications as *Kallstroemia*, *Evolvulus*, or *Gramma*. The lithe, slender, gracefully irregular whips, tipped with a scarlet flame, are more than *Ocatilla*. Against the western sky the serrated wall becomes a chief's war-bonnet of eagle feathers. The outline of the eastern wall is a perfect profile of the great Apache leader, sleeping on his own mountain chain, a mammoth statue wrought by his mother, the earth. His stern face is ironic as the new race tries to put fetters of civilization on this untamed wild creature, the desert. He might almost be thought to smile, when the mirage paints lakes, trees, shade and habitations, to lure the unwary newcomer to barren land, drought, burning heat and death. The epic of this vanished people is a research of different order from those mentioned above, but it is as much a part of the valley as the physics, chemistry, mathematics, and anthropology.

There are other artistic features besides the poetic. For when the painter sees the sun-washed surfaces of the Galiura mountains, with their translucent purple, heliotrope, lilac, amethyst, violet, and ultramarine; the ochre, saffron, gold, burnt gold, salmon, glowing orange, and scarlet; the ghostly beryl, the spirit emerald, the turquoise green, all the play of delicate color that cannot be named, making the mountain walls look like the vari-colored petals of some blossom created by the magic of a genie, he sees

a living beauty behind these silken veils, and paints a canvas which is the record of his researches. When he sees the long sunset shadows creep across the valley floor with its oriental carpets, bringing out the rose and violet of some scraggly yucca as it stands out against the indigo sky, while the distant mountains fade into pale aquamarine tints like dreams that steal away in the gathering twilight, his record contains a truth as great as any that may be written about the ores under the hill-tops. When he catches the dance of the sand-devil whirling in the arms of the hot wind, he puts the passion of this burning land on his canvas.

And the musician sits enraptured while the mockingbird pours out his heart in an ecstacy of joy, and reports his research later in symphonic poems of great beauty. He will catch the elusive motif of the mountain-brook, the faint rustling of the moonlight on the grass. Even the alkali lake, tossed by the wind, beats a rythmic melody on its sands, and the long mathematical curls hold a faint harmony for him that hath ears.

The architect that built these towers and castles, spires, domes, and minarets, knew more than five orders, and left them on record for coming artists to copy. The statues sculptured by the elements have their own curves of beauty, and they will stand there for ages and ages.

The valley is filled with material for the research of the artist as it is for the anthropologist, the scientist, or the mathematician. And when we would comprehend the world in its entirety, we cannot neglect any of the results of any type of research. The world is an indivisible unit, not a parcel made up of laws and facts from science, anthropology, mathematics, or art. Each of these has a view which is only partial. Each is attentive only to certain

features, and the real world is far more than their fragmentary pictures of it.

Whether it be the Mathematician playing with his ideal geometries, algebras, and logics; the Artist in his warmer world of Aesthetics and Aspirations; the Anthropologist studying Man as interwoven with the World; or the Scientist who probes deep for eternal Laws; all are engaged in Research. For what is Research? It is more than the determination of a vapor-pressure, the calculation of a new function-table, or the study of some new-found pottery. It is the "passionate and disinterested curiosity of the human intelligence" (Picard). It is the young eagle trying his wings. The Universe has no terrors for Research. Its world contains the stern clutch of the polar cold, the burning languor of the tropics, the unclean leper, the black death, the vilest diseases, the most dangerous gases, the most violent explosives, the lightning's shafts, the sun's javelins, the depths of the South Sea, the heights of Mt. Everest, the fang of the snake, the sleep of the anesthetic, the hypnotic trance, the ravings of the insane. Alike for it are the wilderness, the city, the slum, the palace, the jail, the saint, the sinner. Research hunts for order, for beauty in the world, for imperturbable law, for the cloud-forms of Time, in nature, in man, in life, in death, in human woe and tears, or human joy and elation. Research holds nothing sacred. It looks for the origin of Man, of the World, of Religion, of God, of Institutions, of Society, of State, of Church, of Man's relations to Man, of Man's relation to Woman. It does not shrink from any depth, nor is it dizzy at any height. Research is not even content with what it finds, but would fain be a Creator, and make new worlds, new beauties, new loves, new hates, new passions, new things, new animals, new men, and new women.

Research is not only passionate and disinterested, it is audacious, ambitious, fearless. It has for its invocation:

"Eastward, where the Sun is kindled;
Northward, Cave where the Wind sleeps in Darkness;
Southward, Swamp where the Snake-Mist rises;
Westward, Plain where the Ghost-Trail goes."

Its benediction is:

"I bow myself to the Quarters,
I salute the Sun and Earth, my parents,
Once more the Song has gone forth,
Like smoke it has vanished in the Sunlight."

—(John Gould Fletcher.)

II. SCIENTIFIC RESEARCH

Scientific research has for its object the statement of laws. This is the same as saying that Science searches for what it considers to be uniformities in human experience. It hunts for the everlasting hills that hold up the four corners of the sky. It experiments over and over on like materials to ascertain if the same results follow. It analyzes the situation in every experiment and tries to ascertain what elements are necessary, what accidental. It endeavors to reduce dependence to a numerical statement, that is, it tries to base its conclusions on measurement. Of course, much of its present content is not altogether so based, perhaps never can be so based, but the attempt is made to reduce all data to numerical form. Science endeavors to be impersonal, to resort to self-registering apparatus, to the camera instead of the eye, to machines that draw their own graphs. Its first aim is a perfectly accurate record of the objective facts.

The facts determined beyond all question of error, self-deception, omission, or imagination, the next problem is to find the laws they imply. This is done first for the obvious connections between phenomena, then as the number increases they are synthetised into more general laws, and these with the assistance of fortunate hypotheses are included in more general statements, the whole: facts, laws, and hypotheses, ultimately constituting a Theory. The theory of celestial mechanics, or theory of electromagnetics, or theory of relativity, or theory of evolution are instances.

Science searches for the Invariants of the world. It desires to discover the permanent in the flowing stream of experience. It dreams of eternal verities, of a stable, essen-

tial structure of the universe, which is not subject to the vicissitudes of chance. Science does not find nor expect to find the capricious, the spontaneous, the free, the spiritual, for it assumes as its subject matter that which is determined. Given the state of the universe at a given instant, its history up to that instant, and the hope of Science is to be able to say what any succeeding state of the universe would be. Science sits patiently unraveling the most tangled threads that the web of phenomena produce, never tiring, never retrograding. Its hypotheses may give way to new ones, and its theories may be included in more satisfactory ones, but the essential results of Science are permanent, and it keeps what it gains. It saves the infant from death, the child from disease and malnutrition, the youth from dangerous ignorance, the adult from premature decay. It corrects educational systems, reduces drudgery, multiplies the yield for labor, increases the time for leisure, removes fear from the world. It gives humanity power over its surroundings, enhances comfort and well-being. It gives more time for reflection. It guarantees progressive evolution of the race. It gives Life and Life more abundantly.

This is a Golden Age for Scientific Research. Thousands are searching the heavens, the earth, the waters, and the waters under the earth, for jewels, small or large, with which to adorn the crown of Science. Since the time of Descartes—the founder of modern science—and his injunction to see, and to see more clearly, the votaries of Science have spread over the earth, examining the microscopic, the telescopic, every nook and cranny of the earth, investigating patiently and thoroughly what they found. Science is a Supreme Court of Last Appeal, in all questions of Natural Law and Invariancy, for it is simply the Human Mind perceiving these things with clear, unobstructed, sharply defined, immediate vision.

III. MATHEMATICAL RESEARCH

When Kepler worked out his famous laws from observations he was doing scientific research. When Newton investigated the meaning of the laws he was engaged in mathematical research. The law of equal areas meant to him a central force. The elliptical orbits of the planets meant that the force varied as the square of the distance. The proportionality between the cubes of the distances and the squares of the periods meant the sway of this force extended to the confines of the solar system. By a flash of intuition he saw it also acting to the ends of the universe, and announced his law of gravitation. This was mathematical research.

Cayley looked at the diagrams of chains of atoms in organic molecules, and they became the theory of chemical "trees." The facets of crystals may all be found from the position of a single one by the laws of groups. The lines of descendants from living beings are threaded with the hereditary characteristics under the laws of combinations and averages. Statistics cannot lie when stretched on frequency curves and surfaces. The miniature solar systems in atoms are mathematical structures. Mathematical research permeates all these.

When Faraday filled space with quivering lines of force, he was bringing mathematics into electricity. When Maxwell stated his famous laws about the electromagnetic field it was mathematics. The relativity theory of Einstein

which makes gravity a fiction, and reduces the mechanics of the universe to geometry, is mathematical research. Wherever a hypothesis is set up and conclusions deduced from it, mathematics is at work. Wherever the scientist goes beyond his observed facts, introducing concepts such as energy, field, propagation of a state, line of force, action at a distance, action in a continuous medium, he is becoming a mathematician. Mathematics is a fundamental mode of thinking, impossible to evade.

Mathematics concerns itself with an ideal world of forms and relations. It constructs new worlds and studies their properties. It undertakes to draw all the necessary conclusions from given data and to point out what other propositions are consistent with the given data. It is not primarily concerned with the applicability of its worlds to that of everyday experience. But so far as this experience can be idealized, divested of its accidental features or its individual properties, mathematics includes the sublimated product among all the other more ethereal creations of its own. It has been defined as the Theory of Pure Forms, in which is meant to be included all the relations and properties of the forms. However, if so defined, it must be understood that the forms are sometimes made of flowing substance, and may in some sense become other forms, while yet retaining their essential properties. Although the definition is inadequate, it is yet quite useful in getting a view of the rôle of Mathematics as one type of Research. Mathematical research is the study of the Universal in the world. It endeavors to find the hidden spirit whose manifestations are numerous, but yet which is One despite its Protean character. It is impersonal, unemotional, not influenced by love or hate, joy or tears. Its worlds are eternal, even though they change like clouds of smoke in the wilful wind. Its additions to human thought are permanent, never decay, never explode, never

give way to others. It verifies laws, it destroys laws. It marks the boundaries of the realms in which theories may reign, it destroys theories. It humbles the arrogance of Logic and Philosophies, it equilibrates the claims of rival factions. It is the Supreme Court of Last Appeal, in all questions of reasoning, not on account of any merit of its own, but because it is after all, nothing but the Human Mind perceiving its own nexus of relations, with clear, unobstructed, sharply defined, immediate, vision.

IV. ANTHROPOLOGICAL RESEARCH

Using the term broadly, Anthropological Research considers Man in every aspect as a function of the World, and the World as a function of Man. For the relation of functionality is symmetric, and if A is a function of B, B is a function of A. Anthropology is not concerned with the general but with the particular, with the human race, a unique product of the world. It studies man's form, structure, anatomy, physiology, neurology; it studies his origin, development, his customs, his traditions, his races, his classes, his societies, his groups, his family, each individual. Anthropology is interested in History and Education. It studies the State, the Church, Cosmopolitanism.

Anthropology is interested in the whole expanse of this tremendous function: Man and his dependence upon many variables. The regular part of the function it calls Civilization. The discontinuities and singularities it calls Revolution and Crises. The late war was a discontinuity in which the infinite ambitions of a few broke the continuity of the function. Anthropology seeks to know the value of this function, whether they all be only finite, or if perchance some may be infinite. It is interested in those ideals toward which man makes an approach but never reaches. It studies his oscillations about positions of equilibrium, his spiral paths, the winding surface of many dimensions which marks the progress of the race, the intersections of civilization with itself; its transition from one level to another. It studies the relations of the development of this function in isolated parts of the earth with

those in other parts. It studies man's reaction to his environment, how the sea makes laws of commerce, the mountains create power, the desert spirituality.

But equally it studies the world as function of Man. It is busy with the account of his inventions, of his increasing control over all the forces of Nature, of his adaptation of the world to his own comfort and better development. It studies the evolution of custom, of law, of order, of government, of the numerous compromises by which Man gains, inch by inch, a greater control over his environment. Sociology, Economics, Political Science, are merely names for some of the divisions of this enormous branch of human activity. For Civilization is a creation, it is not a product of nature.

There have always been investigators of this part of human experience, for mankind is interested in studying man. The first thinker, the first seer, the first priest, the first story-teller, must have had for his daily thought the question: How did I get into this world, and what is my relation to it? Many of the keenest minds today are studying this, the Great Function.

Anthropology has had its hypotheses. Read Plato's Republic, More's Utopia, Well's History, Buckle's History of Civilization. Read the History of Philosophy, of Art, of Mathematics, of Science, of Human Thought. Anthropology has witnessed many tremendous experiments, for they last for centuries. Experiments have been made in social schemes, in religious schemes, in schemes for the family, many inventions besides those of material things. Slavery was an invention, and experimented with. Marriage is an invention, and experimented with. The Church is an invention and experimented with. The State is an invention, and its experiments have been calamitous. Law is an invention, and has evolved into what we have today. Socialism and Bolshevism, Conservatism and Radicalism,

are inventions that are continually under experiment. The discoveries for the race have been numerous. The pages of History are eloquent with functional theorems: "The wages of sin is death!", "Persecution encourages a cause!", "Man develops immunity to some poisons, but is anaphylactic to others," "The race and the opportunity must fit." Sociology, Political Science, Psychology, Education, Philosophy have all discovered theorems as fundamental as those of Science or Mathematics, but of a different type. Law and Universal Form are one thing, Functionality a different thing, each has its theorems. Anthropology is also a Court of Last Appeal, in all questions that concern the interwoven relations of Man and the World, for it too is the Human Mind observing the past and the future with clear, unobstructed, sharply defined, and immediate vision.

V. ARTISTIC RESEARCH

The Dreamer of dreams is also engaged in Research. He is not, like the Mathematician, looking for the Universal; nor like the Anthropologist, looking for the intertwined threads of the web of Man and the World; nor like the Scientist, searching for the uniformities of human experience; his object is the Romance of the world, the fascinating mystery that lives behind every veil. The Architect's touch makes stone float in air; the Sculptor's plian: fingers mould the invisible forms that are pleading for expression; the Painter's purple light and glowing mountains beckon man to the enchanted lands; the Musician's witchery speaks to the heart from incarnated forms of ethereal life; the Poet uses verse and prose to write the Divine Comedy and the Human Comedy. Each is engaged in research behind the phenomenal screen. Like other investigators the Artist is hunting reality.

He investigates the aspirations of man, his hopes, his desires, his dreams, his visions. His methods are his own. No rigorous reasoning with its fine steel net can catch the cloud-forms of his domain. No balance can weigh the character of Hamlet; no spectroscope can resolve the Ninth Symphony; no electrometer measure the potential in the Descent from the Cross. No Institution of society can imprison the subtle mist that bloweth where it listeth. But just as in Mathematics the imaginary becomes the guide to the common; just as in Anthropology the ideal of liberty, fraternity, and equality, emancipates woman, de-

thrones czars, educates the slave; so too the reveries of the Artist create new elements of life, give greater sustenance to the wings of the mind, infuse the spirit of man with new daring.

The Artist enunciates truths. They have often startled the race with their subtlety and profundity. Each school of art has seen a new vision, some new expression for these inner forms continually struggling for the right to be born, some new idea of sculpture, painting, music, of literary creation. They are experimented with, refined and finally accepted, just as are truths of mathematics, anthropology, or science. Not that every new creation of art has had its chance, any more than have all the new ideas of scientists, mathematicians, or anthropologists. The mind of man evolves but slowly.

"There was once a little girl, to whom an elderly friend gave a hyacinth bulb. "Little girl," she said, tossing up in her wrinkled hands the bulb, wrapped up in its balloon silks, "little girl, there is enclosed a miracle here; indeed, my child, life, joy, blowing color, perfume shut up in a jealous flask. It is a fine gift, a fairy present. Guard it well!" The little girl adored the hyacinth bulb, said her prayers while looking at it, nursed it like a doll, put it under her pillow at night, kissed it fondly upon waking, even took it out for a walk. But, alas! without water, without earth, without rest, the unhappy bulb withered, without ever permitting a tremor in a little green tongue, which even in the dark cellar it had put out at the face of life, as a matter of principle. And the disappointed little girl one day threw it in the face of the vexed old lady.

"Alas! Man is the child clinging to his hyacinth bulb, and with it withers his dearest desires, his hopes, his dreams." (Gérard D'Houville.)

Art searches for the spiritual, the ideal, the spontaneous, the free, knowing that these are the real, the immortal.

A tear and a laugh mean more to it than an atom, a curve, or an institution. Art also is a Supreme Court of Last Appeal, in all questions of the spontaneity of Man and the World, for it too is the Human Mind perceiving the things of the Spirit with clear, unobstructed, sharply defined, immediate vision.

VI. THE SPIRIT OF RESEARCH

The Spirit of Research is the aspiring soul of man beating its wings against its limitations. In itself it finds the power of flight, the power of vision, the power of creation. It is not confined to what is in the field of view of a microscope, however minutely accurate. It is never content with the habitation it has built, however convenient the furnishings. It rises on the rarefied air of Mathematics that it may see the more distant horizons; it supports itself on the solid objectivity of Science that it may transmit its creations to posterity; it studies the intricate game of Man versus Nature in order that it may find the paths on which it may go farthest; it utilizes the creations of the Artist as patterns for its own spiritualized creations. Its characteristic is creative life, for it emanates from Life, not from mechanism. What it does is the spontaneous outcome of Activity.

The true scientific research is shown in Newton: "Playing like a boy on the seashore, diverting himself in now and then finding a smoother pebble or prettier shell than ordinary, whilst the great ocean of truth lies all undiscovered before him." It is shown in Poincaré: "Who was willing to work, to suffer, to pay for his seat at the show, in order that he might see, or at least that those who came after him might see." True mathematical research meets the criterion of Emerson: "We do not listen with the best regards to the verses of the man who is only a poet, nor to his problems if only an algebraist; but if a man is at

once acquainted with the geometric foundation of things and with their festal splendor, his poetry is exact, and his arithmetic musical." The true anthropological research meets the test of Henry Adams: "History has never regarded itself as a science of statistics. It is the Science of Vital Energy in relation with time; and of late this radiating center of its life has been steadily tending—together with every form of physical and mechanical energy—toward mathematical expression."

The Spirit of Research inspires the mind "to creep from fancy to the fact, and thus find progress, man's distinctive mark" (Browning). The Spirit of Research is like Socrates, who wished to know not only what seemed to be true, but what it meant for the Soul and how far it could carry man on his upward flight. The Spirit of Research is LIFE with its two wings: Intelligence and Sympathy. It is on its forward flight, impelled by the urge of an inner power. It rests but a moment on any crag, however solid; it drinks but an instant at any spring, however fresh; for from the beginning of the World it has had a Vision whose beauty, whose intoxication, whose smile, eternally say: COME.

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A COMPARISON OF THE ETHICAL PHILOSOPHIES OF SPINOZA AND HOBBS

IF ONE could believe that a philosophical system emanates full-fledged from the mind of a single thinker, as Athene from the head of Zeus, he might venture to decide the extent to which one philosopher is indebted to another for the elements of his system. But, in point of fact, the task of awarding credit where credit is due varies directly in magnitude with the quantity of literary remains of the age under investigation. For philosophies originate out of the vague and ill-defined thoughts of multitudes of individuals. When a Plato or a Hobbes ultimately gives clearly and distinctly a systematic and classic expression to what previously existed more as an attitude than a way of life, more as a mood and a feeling than as a logical and intellectual formulation, we quite properly give homage. But as our acquaintance with the environment giving birth to this expression becomes more detailed and intimate, the more keenly do we realize that our Plato or our Hobbes has succeeded in stating better, more clearly, more consistently and more forcibly what weaker minds strove to convey. Indeed, it seems that philosophers like inventors build upon the trials and errors of their predecessors and contemporaries.

Consequently, we shall not attempt to determine precisely how far Spinoza is indebted to Hobbes, although we know he read him thoroughly. Some critics are so

rash as to consider Spinoza no more than a disciple of Hobbes, while, on the other hand, Duff, who has produced one of the most complete and careful studies thus far made of Spinoza's political philosophy, contends that Spinoza follows St. Paul more than Hobbes, and states, "a deeper influence than that of Hobbes was exercised by Hobbes' master, Machiavelli."¹ Duff's study, together with Pollock's excellent comparison of Hobbes and Spinoza, furnishes us with a thorough contrast of their political philosophies.

Our interest here is primarily in their moral philosophies, but since politics is one application of ethics, we shall have to treat of their political views in so far as these throw light upon their moral programs.

A suggestive approach to a study of the differences and similarities in the ethics of Hobbes and Spinoza is found in their opinions regarding the function of the state. According to Hobbes, *one* motive prompts men to institute a state—*fear*. The state of nature is a condition of war. Each man seeks to realize his desires, to enhance his power, and in so doing conflicts with others bent upon a like object, and the liberty (*Jus Naturale*), which he has "to use his own power, as he will himself, for the preservation of his own Nature"² and thus to appropriate the goods and services of other men is scant compensation for the dangers thus entailed. "In such condition, there is no place for Industry; because the fruit thereof is uncertain: and consequently no Culture of the Earth, no Navigation, nor use of the commodities that may be imported by Sea; no commodious Building; no Instruments of moving, and removing such things as require much force; no Knowledge of the face of the Earth; no account of Time; no Arts; no Letters; no Society; and which is worst of

¹ *Spinoza's Political and Ethical Philosophy*, p. 6.

² *Leviathan* (Everyman Edition), Ch. 14, pp. 66.

all, continual fear, and danger of violent death; and the life of man, solitary, poor, nasty, brutish, and short."³

Fear prompts reason to devise a condition of peace. . . . "As long as this naturall Right of everyman to every thing endureth, there can be no security to any man (how strong or wise soever he be), of living out the time, which Nature ordinarily alloweth men to live. And consequently it is a precept, or generall rule of Reason, *That every man, ought to endeavor Peace, as farre as he has hope of obtaining it; and when he cannot obtain it, 'hat he may seek, and use, all helps, and advantages of Warre.* The first branch of which Rule, containeth the first and Fundamentall Law of Nature; which is, *to seek Peace and follow it.* The Second, the summe of the Right of Nature; which is, *By all means we can, to defend our selves.*"⁴

The motive then for establishing the state is fear, and the end sought is individual self-preservation. If man could live an ideal life, it would be, for Hobbes, a state of absolute subjection of others and absence of impediments to the desires of self. The absolute ruler most nearly embodies this ideal, for he alone enjoys the services of others without obligation to repay in kind. The average citizen, however, endures the state as a necessary evil. He assisted in its origin and helps to sustain it in order to avoid the worst possible calamity, a relapse into the state of nature. The contract then which creates the state is a renunciation of certain liberties or rights in return for protection and the liberty to gratify other desires. Nor does Hobbes believe he contradicts himself when he insists that in the event of a conflict between individual judgment and that of the monarch, the former shall yield. The individual must yield, he insists, because originally he agreed to place the making of decisions in the hands of the state,

³ *Ibid.*, Ch. 13, p. 65.

⁴ *Ibid.*, Ch. 14, p. 67.

and, further, should men follow their own opinions society would disintegrate, and revert once more to "a warre, as is of every man, against every man."

The function of the state, as Hobbes views it, is thus essentially negative. As against anarchy or absolutism man selects the lesser of two evils—absolutism. And the laws of nature, which Hobbes calls the precepts or general rules of Reason, he sums up in a negative statement of the Golden Rule: "Do not that to another, which thou wouldest not have done to thy selfe."⁶ Security is found in obeying the law, but a truly thoughtful and reasonable man must surely balance constantly in his mind the advantages of conformity to law as against a realization of his own desires.

Spinoza conceives the state otherwise. It is true there is a semblance of Hobbes in his account of its origin, for release from fear is one of the motives he mentions. But whereas Spinoza insists that at best fear is a poor motive, a passion in the individual, and a constant danger to the security of the state, Hobbes believes that life is never without fear,⁷ and "the terrour of some Power" is the permanent basis of the commonwealth.⁸ Hobbes, to be sure, realizes the advantages of co-operative endeavor, but for Spinoza mutual aid is the ultimate justification for social organizations and the indispensable means of realizing man's true happiness. Thus he writes in the Theologico-Political Treatise: "The formation of society serves not only for defensive purpose, but is also very useful, and, indeed, absolutely necessary, as rendering possible the division of labor. If men did not render mutual assistance to each other, no one would have either the skill or the time to provide for his own sustenance and preservation: for all men are not equally apt for all work, and no one

⁶ *Ibid.*, Ch. 15, p. 82.

⁷ *Ibid.*, Ch. 6, p. 30.

⁸ *Ibid.*, Ch. 17.

would be capable of preparing all that he individually stood in need of. Strength and time, I repeat, would fail, if every one had in person to plough, to sow, to reap, to grind corn, to cook, to weave, to stitch, and perform the numerous functions required to keep life going; to say nothing of the arts and sciences which are also entirely necessary to the perfection and blessedness of human nature. We see that peoples living in uncivilized barbarism lead a wretched and almost animal life, and even they would not be able to acquire their few rude necessities without assisting one another to a certain extent."⁸ And again, when discussing the foundations of the state: "Nevertheless, no one can doubt that it is much better for us to live according to the laws and assured dictates of reason, for, as we said, they have men's true good for their object. Moreover, everyone wishes to live as far as possible securely beyond the reach of fear, and this would be quite impossible so long as everyone did everything he liked, and reason's claim lowered to a par with those of hatred and anger; there is no one who is not ill at ease in the midst of enmity, hatred, anger and deceit, and who does not seek to avoid them as much as he can. When we reflect that men without mutual help, or the aid of reason, must needs live most miserably, as we clearly proved in Chapter V, we shall plainly see that men must necessarily come to an agreement to live together as securely and well as possible if they are to enjoy as a whole the rights which naturally belong to them as individuals, and their life should be no more conditioned by the force and desire of individuals, but by the power and will of the whole body. This end they will be unable to attain if desire be their only guide (for by the laws of desire each man is drawn in a different direction); they must, therefore, most firmly decree and establish that they will be guided in everything by reason

⁸ *Works* (Bohn Edition), Vol. I, p. 73.

(which nobody will dare openly to repudiate lest he should be taken for a madman), and will restrain any desire which is injurious to a man's fellows, that they will do to all as they would be done by, and that they will defend their neighbour's rights as their own.”⁹

Spinoza saw clearly wherein he differed from Hobbes, and he states in a note to Chapter 16 of the *Theologico-Political Treatise*: “Now reason (though Hobbes thinks otherwise) is always on the side of peace, which cannot be attained unless the general laws of the state be respected.”¹⁰ And in Part IV of the *Ethics*, he writes, “Now, if men lived under the guidance of reason, everyone would remain in possession of this his right (his natural right) without any injury to his neighbour.”¹¹ That is, whereas Hobbes considers the desires and wants of men inevitably bring them into conflict, Spinoza insists that it is only passion, the irrational and ill-informed opinions of their wants, which lead men to disagree. The true needs of men are in harmony and are realizable most fully in society. The state, for Spinoza, as for Hobbes, is a necessary evil; but it is a necessary evil, according to Spinoza, only because and in so far as it must resort to means which are a poor substitute for rational behavior. “Wherefore, in order that men may live together in harmony, and may aid one another, it is necessary that they should forego their natural right, and, for the sake of security, refrain from all actions which can injure their fellowmen. The way in which this end can be attained, so that men who are necessarily a prey to their emotions (IV., iv. Coroll.), inconstant, and diverse, should be able to render each other mutually secure, and feel mutual trust, is evident from IV., vii. and III., XXXIX. It is there shown, that an emotion can only be restrained by an emotion stronger

⁹ *Ibid.*, Vol. I, p. 202.

¹⁰ That is, of course, the laws of a democratic state.

¹¹ *Ethics*, IV, Prop. 37, note 2.

than, and contrary to itself, and that men avoid inflicting injury themselves.”¹²

The best state then would be one which governs rationally; that is, one which establishes laws enabling men to develop and expand the potentialities of their nature. Consequently Spinoza opposes an absolutism and favors a democracy. “In a democracy, irrational commands are still less feared: for it is impossible that the majority of a people, especially if it be a large one, should agree in an irrational design: and, moreover, the basis and aim of a democracy is to avoid the desires as irrational, and to bring men as far as possible under the control of reason, so that they may live in peace and harmony: if this basis be removed the whole fabric falls to ruin.”¹³ As a necessary means to rational legislation, Spinoza pleads for the utmost freedom of thought and speech, distinguishing sharply between obedience to law and the expression of opinions regarding the wisdom of particular legislation.¹⁴ “No,” he exclaims passionately, “the object of government is not to change men from rational beings into beasts or puppets, but to enable them to develop their minds and bodies in security, and to employ their reason unshackled; neither showing hatred, anger, deceit, nor watched with the eyes of jealousy and injustice. In fact, the true aim of government is liberty.”¹⁵

A difference in conception as to the function of the state carries with it a corresponding disagreement as to the nature and purpose of the individual. But here again, on

¹² *Ibid.*, IV, Prop. 37, note 2.

¹³ *Theologico-Political Treatise. Works*, Vol. I, p. 206.

¹⁴ See Ch. 20 of the *Theologico-Political Treatise*. A comparison of this chapter in Spinoza with chapter 29 in Hobbes' *Leviathan*, “Of those things that Weaken, or tend to the DISSOLUTION of a Common-wealth,” will reveal the gap separating the two men. Contrasting what Hobbes has to say about the reading of the ancient writers with this title page of Spinoza's treatise: “Wherein is set forth that freedom of thought and speech not only may, without prejudice to piety and the public peace, be granted; but also may not, without danger to piety and the public peace, be withheld.”

¹⁵ *Theologico-Political Treatise. Works*, Vol. I, p. 259.

first reading, Spinoza seems to repeat Hobbes. Reason, says Hobbes, "is nothing but Reckoning."¹⁶ And it is no more than a reckoning of consequences in terms of personal self-preservation, enhancement of vital motion and increase in power. Spinoza seems essentially to repeat Hobbes when he writes, "it is the sovereign law and right of nature that each individual should endeavor to preserve itself as it is, without regard to anything but itself."¹⁷ And again, ". . . in no case do we strive for, wish for, long for, or desire anything, because we deem it to be good, but on the other hand we deem a thing to be good, because we strive for it, wish for it, long for it, or desire it."¹⁸

But it is no mere repetition of Hobbes, for Spinoza does not mean the same thing by reason, nor is his individual an insulated atom. Hobbes considers that reason recognizes little in common between men, nor does it seek to ascertain their mutual welfare. It serves rather to gratify the possessive impulses and to obtain individual advantage. When contrasting man with the bees and ants whose "Common good differeth not from the Private," Hobbes points out that "man, whose Joy consisteth in comparing himself with other men, can relish nothing but what is eminent."¹⁹ Spinoza, however, believes that reason frees man from an isolated and miserable condition and in operating according to notions common to all men, it contributes to their mutual welfare. The rational life unites man to man. In the state of nature man has a natural right to gratify any and all desires, but this state of nature is not something actually prior to and apart from a social medium. The state of nature is merely a condition of subjection to passion and ignorance. Natural right means no more than a natural tendency to act under certain

¹⁶ *Leviathan*, Ch. 5, p. 18.

¹⁷ *Theologico-Political Treatise. Works*, Vol. I, p. 200.

¹⁸ *Ethics*, III, Prop. 9, note.

¹⁹ *Leviathan*, Ch. 17, p. 88.

conditions. Consequently, to say, "the ignorant and foolish man has sovereign right to do all that desire dictates, or to live according to desire," just as "the wise man has sovereign right to do all that reason dictates,"²⁰ is not to undermine sound morality; it is merely to say that if one lacks reason and is ruled by passion, he can act only in accordance with passion. Reason frees man from this hopeless state. It enables him neither to exploit another, nor to realize his desires at the expense of others—as it can very well do for Hobbes. As Spinoza conceives it, "men, in so far as they live in obedience to reason, necessarily do only such things as are necessarily good for human nature, and consequently for each individual man."²¹ Reason thus supplies us with a criterion by means of which we can select those activities which at once aid us and assist others. Reason breaks down man's isolation; Hobbes' individual remains forever apart from others. In short, that deplorable state which Spinoza calls passion, the bondage of man, from which reason frees him, is for Hobbes the permanent condition of man. Human reason may, according to Spinoza, succeed in inaugurating an era of good will. Life, for Hobbes, is always a pugilistic encounter, and the best reason can do is to substitute gloves, a referee, and Queensbury rules for bare fists and go it as you please until the first man drops.

This difference in ultimate purpose applies as well to their conceptions of self-preservation. For each self-preservation is an increase in power, and power is stimulation of vital activity. Pleasure and pain, Hobbes defines in terms of motion.²² But Spinoza will not object to describing emotions as modifications of Extension. He merely insists that we remember (what Hobbes denies) that vital motion and a thought activity are two aspects of one and

²⁰ *Theologico-Political Treatise*, Vol. I, p. 201.

²¹ *Ethics*, IV, Prop. 35, demonstration.

²² *Leviathan*, Ch. 6.

the same thing.²³ Had Spinoza chosen to treat emotion in the language appropriate to the Attribute of Extension he would not have profoundly disagreed with these statements from Hobbes: "The Endeavor, when it is toward something which causes it, is called Appetite or Desire." "And when the Endeavor is fromward something, it is generally called Aversion."²⁴ It is only when we inquire of each, "What is the final goal of endeavor, the ultimate end of self-preservation?" that we receive profoundly different replies.

Hobbes denies outright the existence of a *Summum Bonum* and contends, "that the Felicity of this life, consisteth not in the repose of a mind satisfied."²⁵ "*Continuall successe* in obtaining those things which a man from time to time desireth, that is to say, continuall prospering, is that men call Felicity; I mean the Felicity of this life. For there is no such thing as perpetuall Tranquility of mind, while we live here; because Life it selfe is but Motion, and can never be without Desire, nor without Feare, no more than without Sense."²⁶ "So that in the first place, I put for a generall inclination of all mankind, a perpetuall and restless desire of Power after power, that ceaseth onely in Death. And the cause of this, is not alwayes that a man hopes for a more intensive delight, than he has already attained to; or that he cannot be content with a moderate power; but because he cannot assure the power and means to live well, which he hath present, without the acquisition of more."²⁷ Carried out logically, this means that might makes right. The strongest desire, in the sense of the most vigorous and permanent desire, is the right desire in the individual's soul, as the strongest arm is the morally justified arbitrator of relations between men. We

²³ *Ethics*, II, Prop. 7.

²⁴ *Leviathan*, Ch. 6, p. 23.

²⁵ *Ibid.*, Ch. II, p. 49.

²⁶ *Ibid.*, Ch. 6, p. 30.

²⁷ *Ibid.*, Ch. II, pp. 49-50.

have observed above that the conflicts between men's interests necessitates the organization of the state; but the decrees of the state are right only because and only so long as the state can enforce its decisions. Hobbes calls upon no man to lay down his life for a lost cause. Self-preservation is the first and the last duty. "If a Monarch subdued by war, render himself Subject to the Victor; his Subjects are delivered from their former obligation, and become obliged to the Victor."²⁸ Right is the interest of the stronger. Such is the conclusion which Hobbes considers to be the dictates of reason.

Reason for Spinoza speaks a different tongue. We have already indicated that Spinoza considers natural law to be no more than a description of things as they are in the absence of organized relations between men. Natural right is not right in a moral sense. And when Spinoza states that "the law and ordinance of nature, under which all men are born, and for the most part live, forbids nothing but what no one wishes or is able to do and is not opposed to strifes, hatred, anger, treachery, or, in general, anything appetite suggests,"²⁹ he speaks not of what ought to be; he merely describes a fact. The laws of nature and natural rights are descriptions of conditions, not suggested programs for action. Spinoza's insistence upon viewing men's vices and imperfections dispassionately and scientifically should not blind us to his acceptance of right as an ideal, and as a valid, objective moral standard. Right is the reasonable. The right act involves in it more perfection and more power than a wrong act. In his study of human nature he means, "by 'good' that which we certainly know to be a means of approaching more nearly to the type of human nature, which we have set before ourselves; by 'bad,' that which we certainly know to be a hindrance to us in approaching the said type. Again, we

²⁸ *Ibid.*, Ch. 21, p. 117.

²⁹ *Political Treatise. Works*, Vol. I, p. 294.

shall say that men are more perfect, or more imperfect, in proportion as they approach more or less nearly to the said type.”⁸⁰

We have seen that Spinoza conceives the rational life as a social life, the life of co-operative endeavor and harmonious relations with one's fellows. Consequently the impulse towards self-preservation which, in Hobbes' opinion, sanctions and renders inevitable a personal aggrandisement and increase in power, becomes in Spinoza's ethics social action and the chief principle of social solidarity. If we act upon Hobbes' convictions we shall never transcend the selfish act; but if we heed Spinoza, in passing from passion to active emotion, we shall transform selfishness into altruistic action.

Indeed, as Spinoza conceives it, true happiness is found only when men act in accordance with rational endeavor. When he points the way to human freedom he insists, as the first condition of emancipation from passion, that we transform a passion into an active emotion, and this we may do by securing a clear and distinct idea of it. Thus, he writes in the note to Proposition 4 of Part V of the *Ethics*: “To attain this result, therefore (freedom from passion), we must chiefly direct our efforts to acquiring, as far as possible, a clear and distinct knowledge of every emotion, in order that the mind may thus, through emotion, be determined to think of those things which it clearly and distinctly perceives, and wherein it fully acquiesces: and thus that the emotion itself may be separated from the thought of an external cause, and may be associated with true thoughts; whence it will come to pass, not only that love, hatred, etc., will be destroyed (V. ii), but also that the appetites or desires, which are wont to arise from such emotion, will become incapable of being excessive (IV., lxi). For it must be especially remarked, that the app-

⁸⁰ *Ethics*, IV, Preface.

tive through which a man is said to be active, and through which he is said to be passive is one and the same. For instance, we have shown that human nature is so constituted, that everyone desires his fellowmen to live after his own fashion (III., xxxi. note); in a man, who is not guided by reason, this appetite is a passion which is called ambition, and does not greatly differ from pride; whereas in a man, who lives by the dictates of reason, it is an activity or virtue which is called piety (IV. xxxvii. note i. and second proof). In like manner, all appetites or desires are only passions, in so far as they spring from inadequate ideas; the same results are accredited to virtue, when they are aroused or generated by adequate ideas. For all desires, whereby we are determined to any given action, may arise as much from adequate as from inadequate ideas (IV. lix)."⁸¹

Consequently, the impulse for self-preservation, which, in Hobbes' system, forever condemns the individual to "a perpetuall and restless desire of Power after power, that ceaseth only in Death," develops quite otherwise for Spinoza. On the plane of Imaginative Knowledge and of passion alone does it oppose self-interest to the good of others. When the impulse expands into active emotion and Rational Knowledge it leads to co-operative relations between men. Says Spinoza: "There are then many things outside ourselves, which are useful to us, and are, therefore, to be desired. Of such none can be discerned more excellent, than those which are in entire agreement with our nature. For if, for example, two individuals of entirely

⁸¹ We should remember, however, that for Spinoza there is no distinction in kind between reason and passion. The idea of the good for him is merely the conscious aspect of an activity. When the activity gets its explanation from external objects acting upon the individual, it is passion. When it is self-directive activity it is active emotion. The increase in knowledge is not so much a cause for the transition from passion to active emotion as a description of the fact. In other words, Spinoza's doctrine of the necessary character of the universe robs the individual of genuine initiative and fundamentally renders inexplicable how on one's own account he can win freedom.

the same nature are united, they form a combination twice as powerful as either of them singly.

"Therefore, to man there is nothing more useful than man—nothing, I repeat, more excellent for preserving their being can be wished for by men, than that all should in all points agree, that the minds and bodies of all should form, as it were, one single mind and one single body, and that all should, with one consent as far as they are able, endeavor to preserve their being, and all with one consent seek what is useful to them all. Hence men, who are governed by reason—that is, who seek what is useful to them in accordance with reason—desire for themselves nothing, which they do not also desire for the rest of mankind, and consequently, are just, faithful, and honorable in their conduct."³²

Spinoza's impulse of self-preservation leads men differently from the way Hobbes describes not merely because, in Spinoza's ethics, egoism, as the last quotation might suggest, is more farseeing than in Hobbes. In a measure such is the case. But Spinoza literally believes we gain our life by losing it. In so far as we live the life of reason we identify ourselves with God and thereby with what is permanent and common in all men. The distinctions which mark off man from man disappear, and as "the bases of reason are the notions which answer to things common to all,"³³ so the essence of individuality that remain when passion broadens out into active emotion is the force which "follows from the eternal necessity of God's nature."³⁴ "Whatsoever we conceive in this second way as true or real, we conceive under the form of eternity, and their ideas involve the eternal and infinite essence of God."³⁵

³² *Ethics*, IV, Prop. 18, note.

³³ *Ethics*, II, Prop. 44, Coroll. 2, demonstration.

³⁴ *Ethics*, II, Prop. 45, note.

³⁵ *Ethics*, V, Prop. 29, note.

And so the impulse of self-preservation properly leads man into the rational life. Only as a rational being does he increase his power and arrive at true independence. "Nay, inasmuch as human power is to be reckoned less by physical vigor than by mental strength, it follows that those men are most independent whose reason is strongest, and who are most guided thereby. And so I am altogether for calling a man free, as he is led by reason; because so far he is determined to action by such causes, as can be adequately understood by his unassisted nature, although by these causes he be necessarily determined to action."³⁶

Thus right, for Spinoza, is no moral justification of things as they are, although it does imply an acquiescence of spirit. But the acquiescence of spirit which the free man possesses is a loyalty to an ideal which, as it were, transcends the environment in which he finds himself. He does not take advantage of the weaknesses of others, nor does he submit to the false valuations which chance to control the social environment in which he lives. He renders back "love or kindness for other men's hatred, anger, contempt."³⁷ Courteously and kindly he tries to lead others by reason,³⁸ and should he fail, he accepts the situation stoically, conscious of its eternal necessity, and "endeavors, as we said before, as far as in him lies, to do good and to go on his way rejoicing."³⁹

We may conclude, then, that Spinoza and Hobbes speak quite differently regarding the function of the state, regarding the ideal social order, the nature and destiny of the individual, the place of reason in human life, and in the character and ultimate purpose of the impulse for self-preservation. Their relation is not that of master and disciple. If we may take an illustration from industrial life,

³⁶ *Political Treatise. Works*, Vol. I, p. 295.

³⁷ *Ethics*, IV, Prop. 46.

³⁸ *Ethics*, IV, Prop. 37.

³⁹ *Ethics*, IV, Prop. 73, note.

we might say that Spinoza's relation to Hobbes is that of a manufacturer to the producer of his raw materials. Hobbes supplies the raw produce, Spinoza makes it over into a new and original article.

Their disagreements find an explanation in the metaphysical backgrounds of the two men. Hobbes is a mechanical empiricist, Spinoza is a rationalist. Spinoza cannot admit that the individual is other than an expression of a deeper and more fundamental reality. Each individual, as he sees it, testifies in a unique way to the boundless and infinite possibilities of Substance; but Substance is an immanent Energy. Man is Substance and Substance is man. In God and in God alone man lives and moves and has his being. Consequently, in identifying his personal ends with the highest good of his fellows, man approaches to the supreme ethical ideal, "a knowledge of the union existing between the mind and the whole of nature."⁴⁰ Hence, the fragmentary and short-sighted character, as Spinoza must see it, of Hobbes' individualism. It is true only as a description of man's condition of bondage; and it has value only as it enables him to escape into the life of reason. Its truth is merely the truth of Imaginative Knowledge. Hence, it lacks ultimate validity both as a description of human relations as they *really* are, and as a program for attaining to a state of blessedness.

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⁴⁰ *Improvement of the Understanding. Works, Vol. II, p. 6.*

THE LOGIC OF DISCOVERY

IT IS CONCEIVABLE that in the nature of things the mind is unable to comprehend its highest movements with clearness. If the act of discovery or invention, in its rarer and more profound phases, is, as it seems to be, one of the highest experiences of the mind, it would then be natural to expect that the mind itself could not explain such an act of invention or discovery. If any portion of the mental processes should thus lie beyond the reach of scientific analysis, one would have a domain in which precision of thought could not be attained. This looks too much like a mystery to be accepted without repugnance. But there seems to be a real difficulty in supposing that the mind can explain, or comprehend clearly, all of its acts. If so, it could explain also the act of explanation, and then this act in turn, and so on, apparently with an infinite regression. Whether such impossible infinite regression can or cannot be avoided, it is clearly a conceivable possibility that certain mental processes cannot be fully apprehended by the experiencing agent, so that one must not assume in advance that the mind can certainly comprehend clearly all of its own movements.

But this conceivable possibility need not at all affect the development of a logic of discovery in the sense of a logic by which one infers from the known to that unknown which hitherto has not been apprehended or suspected. It is with the laws of such inference that a logic of discovery

will be concerned. The data from which one starts and the conclusions reached through the use of these laws will be clearly apprehended in their relation to the process; and the completed act with its several steps can be held up, as it were, before the mind for inspection and analysis. The processes of thought in such discovery may be studied objectively after the act by means of the remembered steps of the inference; and the laws of such inference may be successfully investigated.

But it must not be assumed in advance that all the processes of discovery are carried forward by means of a logic—the inference from known to unknown. It is conceivable that any logic of discovery will necessarily leave out of account some of the most characteristic acts of discovery. One might prefer to avoid this conclusion, but one must be prepared to face the possibility. As J. A. Thomson has said: "It may be that the imaginative brooding suggests a solution in some way that we do not at present understand—life is essentially creative; it may be that there is a more or less unconscious cerebral experimenting; it is certain that letting the mind play among facts has often led to magnificent conclusions. It seems that the solution is often reached first and the proof supplied afterwards." There is the conceivable possibility of an actual creative activity of the intellect which is not suitably analyzed in terms of any logic of inference from the known to the unknown. It is clear that many of us wish to have our universe so tidy that nothing actually novel could happen in it, that every event should be a mere consequence of what had preceded it. But there are others who would not object to the surprises of true novelty, who indeed would be pleased with them rather than disconcerted by them. But the matter is controlled by the wishes of neither group. The question is one of fact, hard to be ascertained perhaps, and not one of opinion.

In this also, whatever the truth may be, it does not affect the development of a logic of discovery. For such creative acts, if they really take place, are outside of the category of inferences from the known to the unknown; and hence lie outside of the domain of a logic of discovery.

To our definition of the logic of discovery as the science of inference from the known to that unknown which hitherto has not been apprehended or suspected, we may add a few remarks as to what it is not by way of more clearly delimiting the meaning of the term. In the first place it is not necessarily a logic of demonstration. One may discover a truth by means of a definite process of inference which leads forward by well-defined steps to a clearly ascertainable proposition without carrying with it a demonstration of that proposition. This is often done by the mathematicians in important ranges of investigation. An actual demonstration of the result thus heuristically attained is then frequently given in a *de novo* argument. If some particular type of inference which is thus often successful should turn out to be always so, in the sense of never leading to false conclusions, one would suspect that a more careful analysis of it would reveal the fact that it could be put into the form of an actual demonstration. But some of these heuristic methods, which are successful in yielding true conclusions when they are sagaciously employed, sometimes lead one also to formulate propositions which turn out to be false. They give a method of discovery which must be checked by a subsequent demonstration of the results. Such a method affords an example of a logic of discovery which is not a logic of demonstration.

We have already considered the possible existence of a creative method of invention which cannot be treated by a logic of discovery, the latter being confined to inferences from the known to the unknown. Such a logic, then, does not take account of all things, even of all important things,

relative to discovery. Some of these may belong to the psychology or the physiology of the investigator. The logic of discovery has to do only with certain laws of inference. If we should think of the body of known truth in a given field as being inclosed in a region beyond the boundary of which lies what is unknown, it might be an important question whether one is most likely to be able to break over this boundary if he approaches it on a gradual spiral path taking him through a large part of what is known already or along a radial path quickly bringing him squarely against the boundary; such a question, whether important or not, would have nothing to do with a logic of discovery. It belongs rather to the psychology of investigation relative to the particular domain of truth. The logic of discovery has to do only with the laws of inference from the known to the unknown.

When we notice to what extent discoveries in science appear to be made in unforeseen ways and how often an accidental juxtaposition of thoughts leads to the detection of something new, we feel that it would be hazardous to miss one link from the chain of scientific progress or leave out of our thought even the least inkling as to what may be a successful logic of discovery. We have not yet learned how to systematically explore new territories of thought. We can only look over the field at random and hope to find here and there a pearl of great price. In the absence of a guiding logic of discovery we have no systematic method of procedure.

Francis Bacon has emphasized this matter, saying, "So it cannot be found strange if sciences be no farther discovered, if the art itself of invention and discovery hath been passed over. That this part of knowledge is wanting, to my judgment standeth plainly confessed; for first, logic doth not pretend to invent sciences, or the axioms of sciences, but passeth it over with a '*cuique in sua arte cre-*'

dendum." He says further: "So it should seem, that men are hitherto rather beholden to a wild goat for surgery, or to a nightingale for music, or to the ibis for some part of physic, or to the pot lid that flew open for artillery, or generally to chance, or anything else, than to logic, for the invention of arts and sciences."

Descartes also speaks much to the same tenor; he says: "I found that, as for logic, its syllogisms and the majority of its other precepts are of avail rather in the communication of what we already know, or even . . . in speaking without judgment of things of which we are ignorant, than in the investigation of the unknown." As to places where he might find correct reasonings, Descartes writes: "For it occurred to me that I should find much more truth in the reasonings of each individual with reference to the affairs in which he is personally interested, and the issue of which must presently punish him if he has judged amiss, than in those conducted by a man of letters in his study, regarding speculative matters that are of no practical moment, and followed by no consequences to himself." But the primary source of that method which is so clearly described in Descartes' classic *Discourse* is in mathematics. He gives the following account: "The long chains of simple and easy reasonings by means of which geometers are accustomed to reach the conclusions of their most difficult demonstrations had led me to imagine that all things, to the knowledge of which man is competent, are mutually connected in the same way, and that there is nothing so far removed from us as to be beyond our reach, or so hidden that we cannot discover it, provided only that we abstain from accepting the false for the true, and always preserve in our thoughts the order necessary for the deduction of one truth from another."

Aristotle was almost entirely concerned with establishing what had been conceived already or of refuting

error, but not with solving the problem of the discovery of truth. Now and then, in reading his organon, one feels that he has almost sensed the nature of this problem, only to find that he lapses immediately into a discussion of the logic of demonstration. He thinks of confirming truth rather than of finding it.

The Renaissance gave birth to the demand for a new organon, "a scientific method which shall face the facts of experience and justify itself by its achievement in the reduction of them to control." Bacon called for the overthrow of the dominant system, for a new beginning, for recourse to nature, for induction in a safeguarded form, for experiment, for a logic of discovery. He objected to the syllogism as constraining assent where we want a control over things. But he did not succeed in his great object of founding a logic of discovery. "It has been pointed out, and with perfect justice, that science in its progress has not followed the Baconian method, that no one discovery can be pointed to which can be definitely ascribed to the use of his rules." Descartes' doctrine of clarity as the supreme criterion for a method of discovery does not come to grips with the real problem. His extension of the method of mathematics into a general method of reasoning and discovery is not adequate to the varied needs of the investigator.

So goes the story through the whole history of logic. The developed systematic logic is a logic of demonstration. Whewell saw that "science advances only in so far as the mind of the inquirer is able to suggest organizing ideas whereby our observations and experiments are colligated into intelligible system"; but he could give no direction for the capture of these organizing ideas. In the article on induction in the *Encyclopaedia Britannica* we read: "The most important faculty in scientific inquiry is the faculty of suggesting new and valuable hypotheses. But

no one has ever given any explanation how the hypotheses arise in the mind; we attribute it to 'genius,' which, of course, is no explanation at all. The logic of discovery, in the higher sense of the term, simply has no existence. Another important but neglected province of the subject is the relation of scientific induction to the inductions of everyday life. There are some who think that a study of this relation would quite transform the accepted view of induction. Consider such a piece of reasoning as may be heard any day in a court of justice, a detective who explains how in his opinion a certain burglary was effected. . . . What the detective does is to reconstruct a particular crime; he evolves no general principle. Such reasoning is used by every man in every hour of his life; by it we understand what people are doing around us, and what is the meaning of the sense-impressions we receive."

Two distinct causes may contribute to the failure to produce a logic of discovery, one having to do with the nature of the mind and the other with the assumed nature of the logic.

It is conceivable, as we have said, that the primary acts of discovery should be so largely or so thoroughly creative in their character that no science of inference from the known to the unknown can be developed; or, if it can be developed in part, that it cannot be adequate except in a very restricted range. If the process is a creative one then it would probably be agreed that it is a process whose movements cannot be predicted or analyzed into cause and effect, so that the ascription of the results solely to creative action would have the effect of closing inquiry into the nature of the process. On the other hand, if the process is truly creative in its nature it is clear that we come to no better understanding of it by shutting our eyes to that fact. But if there exists at all such a method of procedure lying beyond the reach of systematic analysis,

it appears to belong to the greater minds and to their rarer moments. In large part the method of discovery seems to belong to a logic of discovery. Leaving unsettled the question as to whether any discovery is truly creative in character, one may justly proceed to ascertain to what extent the methods of discovery can be described in terms of a science of inference. If in the nature of things we are kept away from the goal of an adequate logic of discovery, we shall nevertheless in this way get as near to it as is possible for us. We shall, however, not fail to remember the fact that we are investigating only one of two conceivable methods of discovery.

It is evident that Bacon conceived of the logic of discovery as a unit which is scarcely separable into parts. Descartes obviously held the same view in a different form. Such seems to have been the opinion of most of those who have sought to develop the subject. In several places, I have met the term logic of discovery but seldom or never the notion of logics of discovery. It is conceivable that the logic of discovery is not one in the sense of something indivisible, but that it is relative to the field of investigation or the point of view so that one should not speak of a logic of discovery in any absolute sense, but only of such a logic as relative to a given discipline or a given goal of investigation.

The usual failure to divide the problem into the parts thus suggested has, I believe, been a chief hindrance to the development of the logic of discovery. The fact that the logic of demonstration is a unit, being the same whatever the field of investigation, has led to a too ready acceptance of the view that a logic of discovery should also be a unit.

Discovery itself may be relative to the point of view of the investigator. Through the changes induced in the philosophy of science by recent advances in physics the

concept of explanation has undergone a considerable modification through the formation of a new list of basic fundamental elements in terms of which explanation has to be made. Of this change Rougier (*"Philosophy and the New Physics,"* pp. 146-147), has written as follows:

"In former days a physical phenomenon was explained by reducing it to the principles of classical mechanics, by giving to its laws the form impressed by Lagrange on the equations of dynamics. To explain a phenomenon today is to give it a statistical explanation, by regarding it as the resultant of a very large number of underlying phenomena governed by the laws of chance. . . .

"Thus not only do the most fundamental categories of our mind, those of space, of time, of causality, pass through an evolution with the progress of science but the same holds even for the concept of intelligibility. To explain a phenomenon is, for primitive man, to interpret it anthropomorphically by a supernatural agent endowed with psychological life in his own image; for a scholastic it is to explain it by ultimate causes; for Maxwell it is to deduce it from the principles of mechanics; for Gibbs and Boltzmann it is to account for it by the calculus of probabilities, by starting from a system of elements subject to given conditions. Human reason is not '*une et entière en chacun*' as Descartes taught. It varies with the abstract or concrete nature of our thought, and in proportion as, on contact with experimental facts, the adaptation of our mind to nature becomes progressively realized."

Now when one modifies the meaning of such a fundamental thing as intelligibility, or explanation, he changes his point of view so radically that he will, in his investigations, look for quite different things from those for which he would otherwise look. There is a great difference between the way of work of one who expects to find the inner secrets of phenomena and that of one who supposes that he

is only to get some convenient shorthand way of expressing the relations of phenomena without any approach to their ultimate explanation. One can set himself to find only those sorts of explanation which he deems to be possible. He may find other things by accident as it were. But he cannot seek them systematically. His logic of discovery, the way he infers in fact as opposed to the way in which he infers perfectly, varies profoundly with changes in his point of view and especially in his view as to what constitutes explanation.

When one conceives a definite law of progress from lower to higher methods of thought, as Comte did in connection with his law of the three states, he will carefully direct his own thought towards what he conceives to be the higher. Indeed, in a case so well marked as that of Comte, he will avoid entirely the methods which are conceived to be of the lower sort and will undertake to carry forward his investigations solely by means of what he conceives to be the higher method. In this way an abstract ideal of excellence, when formed in accordance with a classification of method as more primitive or more secure, necessarily dominates the order of procedure in demonstration. The logic of discovery is a function of the ideal of excellence in different sorts of truth; it depends on the point of view.

With the conception of scientific explanation which is prevalent in our times it would be quite impossible for one to proceed as Descartes proceeded. One of his editors says of him: "Refusing to let himself be hindered by lack of adequate information, he thought out what the constitution of the world and man must be if they were to be clearly understood." Descartes conceived of clearness of thought as a criterion for truth and was convinced that God had arranged things so that true knowledge is possible. Then if it were true that the ideal of clearness of thought could

be attained under only one conception of the nature of God and the world and man, then this must be the valid conception of these things. Out of the mind itself and the ideal of true thinking which was imposed upon it, he believed that some of the most momentous conclusions of science could be deduced without any experimental evidence. The necessary type of scientific explanation could be deduced by considerations having to do with the mind itself. He realized that experience is necessary for details; but the fundamental terms in which the explanation must be made he deduced by means of his ideal of clearness of thought.

The logic of discovery which is implicit in this type of argument makes no strong appeal to scientific thinkers of our day. It depends upon a conception of nature and thought too far removed from what is now current. But the example serves to enforce the fact that such a logic may be relative to the ideal elements in the point of view.

Before one can proceed to a detailed development of any logic of discovery it is important that he shall determine in what part of the thinking process is to be found the essential step of discovery. It is clear that it is not in the proof of a proposition once conceived, even though with uncertainty; the latter requires only the use of the logic of demonstration, whether the conjectured proposition is established or shown to be false. The essential step is in a much more original act. It is in the formation of the conjecture itself or goes back even farther to the formation of the hypothesis out of which comes the proposition to be tested, whether by experiment or by reasoning. It may even be found in a more remote place in the process of discovery than this, its chief element resting in a principle partaking somewhat of a metaphysical nature (as in the general principle of relativity), or in an ideal of a purely abstract character (as in Descartes' doctrine of clar-

ity). It is as if the mind were seeking to impose itself upon nature, insisting that whatever explanations we may finally adopt they shall be such as satisfy the requirements of a norm set up by the mind itself. Certain of these demands may be impossible of realization. One then constructs a norm of a modified sort. The essential step in discovery is in the construction of definite hypothesis in the form of a particular or a general law or proposition and in the formulation of a principle or norm lying back of the hypothesis and contributing effectively to giving it existence.

Galileo informs us that he discovered by reason the law of distance for falling bodies and that he afterwards verified it by experiment. The Copernican assertion of the motion of the earth is neither a deduction of the pure reason nor a datum of experience but an hypothesis which has been verified. Kepler can tell us the precise date on which he conceived correctly the relation of periodic times in planetary motion though it was more than a month afterwards before he succeeded in verifying the law by detailed computations. The law of gravitation offered itself clearly to Newton's thought in 1666, but was temporarily discarded from lack of agreement with recorded observations, to be revived and accepted later when more accurate observations were available for a better check. He was so agitated over the possibility that these new observations would verify his theory that he got one of his friends to undertake the necessary computations for him because in his emotional excitement he did not feel capable of doing it himself. The laws of nature, in the absence of sufficient experimental evidence to prove them, are often conceived through a happy combination of thoughts in the mind of the investigator. Innumerable useless combinations are passed over and the vital ones rise to consciousness to bring new truth to light.

An instructive failure to realize the importance of new hypothesis in physical science is brought out by the following two paragraphs taken from the "Register" of one of our leading American universities where they appeared regularly for a decade and a half overlapping the end of the last century and the beginning of this:

"While it is never safe to affirm that the future of Physical Science has no marvels in store even more marvelous than those of the past, it seems probable that most of the grand underlying principles have been firmly established and that further advances are to be sought chiefly in the rigorous application of these principles to all the phenomena which come under our notice."

"It is here that the science of measurement shows its importance—where quantitative results are more to be desired than qualitative work. An eminent physicist has remarked that the future truths of Physical Science are to be looked for in the sixth place of decimals."

This conception of the state of physical science seems to have had considerable currency in the earlier nineties. Since then a veritable revolution has taken place. New theories have sprung up and have manifested remarkable vitality. An eminent physicist has advised the young men to try all sorts of "fool experiments" on the ground that there is no way to anticipate what remarkable things may thus be brought to light. After a period in which successful hypotheses were seldom formed there has come one when new and even startling hypotheses have followed one after another with bewildering rapidity, and physical science has taken such a leap forward as has been witnessed only two or three times in its history.

This emphasizes the importance of the place of hypothesis in the process of discovery.

The logic of demonstration is by definition only that sort of logic which compels assent to the conclusion when

the premises are granted. It is this logic by which one is always to establish those results which are to be made secure in virtue of their logical dependence on results which are already known to be secure. It is the universal method of the mathematician when he sets forth for others the proofs of the truths discovered by him. In the natural sciences it is often true that one must start from principles which are only probably, or even only conjecturally, true. There is always the possibility that some new phenomenon will be brought to light not in agreement with the principles already accepted, so that one never establishes precise results with compelling logic. There is always the need for an experimental test. In a certain part of mathematics this is not so, namely, in that part in which the doctrine advanced gives rise admittedly to a body of results that follow from given postulates which are accepted.

This marked difference between mathematics and physical science is not altogether so universal as has sometimes been supposed. In some fields, as in that of the theory of numbers for instance, we are dealing with a set of objects which we assume ourselves to know so thoroughly that our basic propositions are not so much postulates as the statement of known properties, as of the positive integers in the field mentioned. It is conceivable that as a matter of fact we do not know the positive integers well enough for this; and that, on the basis of the initially accepted properties, we may be led to some result not holding for all positive integers. We should then be compelled to modify our statement regarding our theorems and say merely that they are true for those entities which satisfy our basic propositions. We have such confidence, through the result of previous experience, that such a breakdown is not going to ensue that we proceed without any systematic experimental verification of our results. We do, however, subject them often to the test of more or less random

numerical verification; and this is in many respects similar to the experimental test in the laboratory of some conclusion in natural science obtained from theoretical considerations.

If it is objected that we do not develop the theory of positive integers from our clear conception of their basic properties but from an assumed basis of postulates, the answer is that the latter is indeed the theoretically satisfying form, but that investigators and expositors in the theory of numbers have for the most part proceeded in the way we have indicated from propositions the truth of which they have granted without question, and have not thought of their work as giving the consequences of certain postulates so much as yielding veritable properties of clearly perceived existent entities. If it is objected that this is not a perfect procedure, it may be said in reply that it is the procedure which has actually been employed. The theory of numbers, as a matter of historical fact, has been developed from certain propositions concerning numbers the truth of which one seems to ascertain immediately from his acquaintance with integers either through experience of them or through the invention or creation of them by the human mind.

These basic truths are closely analogous to the laws of the physicist. Perhaps one has a right to accept them with greater confidence than is legitimate for the physicist in his more complex domain; but the ground of the confidence seems to be of essentially the same sort, the increased confidence being due to our fuller knowledge of positive integers than of electrons for instance. Whether this fuller initial knowledge is due to the fact (if it is a fact) that the human race created integers or is due to a longer and more intimate experimental acquaintance with integers does not seem to alter the essential character of this initial knowledge. If we accept the principles of an exact logic

and agree to a given set of basic propositions, then we necessarily accept the results which flow from these propositions by means of these logical principles. Thus we are accustomed to begin the development of the theory of positive integers, not from a body of assumptions but from a body of propositions which we agree are true of positive integers—for instance, the proposition that the larger number A of two positive integers can be written as a sum of two terms one of which is an integral multiple of the smaller number B and the other is zero or a positive integer less than B. These we take not so much for postulates as for true propositions from which we begin our argument.

There are two possibilities concerning the character of this knowledge. Either we have it by an immediate insight or intuition of its truth; or we have attained it on some sort of experimental basis. If it is by the former, then we have no suitable means of knowing the validity of our insight; if it is by the latter, then we cannot be said to have tested the matter fully until we have examined every aspect. But to examine every aspect of it we shall have to verify every logical consequence of the originally accepted propositions. Then we can never be said to know fully the truth of a proposition which we have derived logically unless we subject it to some sort of experimental test, provided that that truth is not merely one which asserts the logical connection of propositions.

Hence, either from the lack of complete certainty of our insight or of the full reach of our experience we are in the position of being short of absolute logical certainty even for our propositions about positive integers. But we have so frequently verified our results in the past that we have attained to an emphatic confidence that they will be verified in the future. Our experimental evidence is great enough to give us a strong feeling of security. And yet it may be observed that workers in number theory still seem

to feel a certain satisfaction in exhibiting numerical verifications of their more abstruse theorems.

This seems to me more like the experimental verification of the natural scientist than is usually supposed. The mathematician does not feel so keenly the need of it as the physicist; but is not this confidence, after all, due primarily to the mathematician's previous experience of almost constant success whereas the physicist has more often reached wrong conclusions, due presumably to the greater intrinsic difficulty of his subject matter? Even the physicist, as we have already seen, has passed through stages in which he was almost absolutely confident of his principles and was looking around only to find means to get the right figure in the sixth decimal place. In biology there appears to be almost the same feeling of absolute certainty that things have come to their present state through some process of evolution which is not merely one cycle in an unending sequence of repeated cycles.

In the progress of knowledge we are concerned both with the logic of demonstration for the firm establishment of truths once suspected and with the way or means by which one may come in the first place to formulate a proposition and to suspect its truth. The question also arises as to whether a sure process of inference from the known to the unknown exists—that is, whether there are well defined characteristic processes, imbued with full logical rigor, by which one may pass directly from the known to the unknown in such a way that in the very passage to the new truth there is inherent the forcible logical demonstration of that truth. Or, should we seek rather some sort of heuristic logic by which one comes first to formulate a proposition whose truth he suspects, while the demonstration of it is to be sought later by more secure processes?

It seems certain that the former alternative is not realized. There is no secure logic of discovery different from

the logic of demonstration. Whatever process of reasoning ends with a new truth, demonstrated as it is attained, is carried out only by a secure logic of demonstration. This does not mean that the latter is never a logic of discovery; in fact, it is often this. Many truths which assert merely the logical dependence of propositions are attained by a logic of demonstration—especially when the propositions are conceived in their abstract form. And not a few others are also derived in this way. Maxwell's prediction of the pressure of light resulted from a truth discovered by a logic which carried with it a demonstration of the fact that this truth is a consequence of accepted laws of physical phenomena. The most striking recent instance of this sort of discovery is that of the bending of a ray of light in a strong gravitational field, as predicted by Einstein in his general theory of relativity.

It appears to me that the use of a logic of demonstration for the purposes of discovery does not afford a typical instance of the logic of discovery. If there is any point to considering the latter at all it is because it has, in important instances at least, characteristic qualities which are worthy of investigation. Accordingly we turn now to a further consideration of the question of the existence of some sort of heuristic logic by which one comes first to formulate a proposition whose truth he suspects, while the demonstration of it is to be sought later by more secure processes. That such processes of inference exist has certainly been recognized since the time of Aristotle. Analogical reasoning is of just this sort and so is the conclusion from the particular to the general. But the problem which we have in mind is not so much that of the general principles of probable but insecure inference, as of that which arises in consideration of some such question as the following:

Have the particular sciences certain heuristic logics and do these vary, in whole or in part, as we pass from one particular science to another? This question forces upon our attention another, namely, the question as to whether all logic is one or whether logic is relative to the field or the subject matter to which it is to be applied. The foregoing separation of logic into two parts seems important here; and we should probably press a two-fold question: Is the logic of secure demonstration one, the same in all ranges to which it may be applied, or is it something relative to the subject matter under investigation? Is the logic of discovery, the guiding but nevertheless not absolutely trustworthy logic of the preliminary stages of an investigation, the same for all ranges of subject matter or is it relative to the subject matter of the different sciences? Without attempting to go into a full discussion of the question we may say that the secure logic of demonstration appears to us to be one and the same whatever the field of investigation. The forms of reasoning which in one science compel assent to its conclusions from accepted propositions are the same as those which in any other science have the same compelling power. One form, for instance, mathematical induction, may be rather frequently employed in one science and appear seldom or never in another; but it is valid wherever it applies and has the same compelling power.

But it seems not improbable that a certain heuristic logic in one science may have no conceivable place at all in another.

In some investigations which I have carried out in the past two or three years, I have had occasion to treat a great variety of related transcendental problems by means of methods to which I was led by certain fundamental algebraic guides to transcendental problems. Such guides appear to have been first employed by Sturm (in 1836) and by Cauchy (see Moigno's lectures, 1844). They were

brought into great prominence in more modern times through the initiative of Volterra whose work in this direction first became explicit in his publications in 1896. They appear to be of such a nature as to be useful only in mathematics; and in fact in only a certain well-defined region of mathematics, though their full value here seems not yet to have been realized in accomplished use. It is of interest to note the sort of results to which they give rise. One is led by them to a more definite and precise formulation of a variety of problems originating from certain applications of mathematics to physical phenomena, the formulation being so sharp and clear as to enable the mind to concentrate its thought upon the leading issues and to avoid the waste due to a distraction of attention by irrelevant matters. The central fundamental theorems around which the detailed theory of these problems gravitates are suggested so clearly by the heuristic process to which one is led in an unmistakable manner as to leave no room for a failure to discover these theorems, at least in a wide range of problems. The process does not directly and immediately afford us a proof of the theorems. But it does yield precise suggestions concerning the method of proof by which one may establish them through a rigorous logical procedure. This particular heuristic logic, then, serves the three-fold purpose of making the problems definite, of suggesting the central theorems, and of indicating suitable methods of proof.¹

Perhaps this example represents the extreme of definiteness and serviceability in these heuristic logics. All gradations exist between this and that other in which the inference from the known to the unknown is through well-defined processes which are imbued with full logical rigor

¹ This heuristic logic afforded the principal subject of my retiring address as Chairman of the Chicago Section of the American Mathematical Society in December, 1921; a detailed account of it for mathematicians will be found in that address as published in the *Bulletin* of the Society for April-May, 1922, pp. 179-210.

and by which one may pass directly from the known to the unknown in such a way that in the very passage to the new truth there is inherent the compelling logical demonstration of that truth. Let us for a moment contrast this latter sort of logic of discovery with the former.

We can get it before us best by taking an example where it would naturally be employed. Let us suppose that one has observed that the positive integers may be separated into two classes: in the one class are those positive integers each of which is a product of two smaller positive integers; in the other are all positive integers not in the first class. Let us call the integers of this second class prime numbers. Let us suppose now that one has already found out in some way that every integer of the first class contains as a factor some prime number greater than unity. Suppose then that he raises the question as to the number of integers in each class. In both classes together there is an infinitude of numbers, since these classes together contain all positive integers. That the first class contains an infinite number of integers is obvious, since it contains an infinitude of powers of each integer or since it contains the double of every positive integer. The question which remains and calls for answer is whether the number of primes is infinite. The answer, complete or in part, must evidently be one or the other of the following: the number of primes is finite; the number of primes is infinite. The order of procedure is obviously to assume one or the other of these alternatives and to test it; if we assume the wrong one we can expect to arrive at a contradiction. Let us try out first the simpler assertion that the number of primes is finite. Then let P be the product of all of them, and consider the number $P+1$. It is divisible by no one of the primes except unity, since we have a remainder of one on any such division owing to the fact that P is now supposed to be the product of all prime numbers. Hence we have a

number larger than any prime and without a prime factor, in contradiction with what we already knew. Hence, the number of primes is infinite. Our question is therefore answered with a precision which may be accepted as tentatively satisfying.

Here the process by which we arrive at the answer to our question contains the proof that the answer is correct. Here the logic of discovery is in no wise different from the logic of demonstration.

But there is something peculiar about this case which is not present in all cases. The question whose answer we sought has by its nature one of a finite number of answers which press themselves at once upon the attention as the logical possibilities, and this almost as soon as one has clearly conceived the question. Let us ask, on the other hand, what is the law of force among the atoms or parts of atoms in chemical combination. There is no such finite set of exhaustive and useful logical possibilities to arrest the attention. So far as the logical elements in the situation are involved there is an infinitude of logical possibilities of co-ordinate importance. What we know about the matter is far too little to compel as inference one or the other of any finite set of useful logical possibilities. We cannot proceed to the desired truth by means of logical processes compelling the conclusion and demanding confidence in the results attained. We need some logic of discovery different from that which is suitable in demonstration.

Such a heuristic logic will be necessary partly (and roughly) in proportion to the definiteness and completeness of the underlying truths already in hand and on which we proceed to build the theory. Such necessity will increase with the complexity of the problem to be investigated and the consequent difficulty of an orderly procedure from the known to the unknown. Hence there are two

stages in the development of a science when one will be in an especial need of a heuristic logic. The first of these is that necessary for a science in the nascent stage of its development when its underlying basic principles are being discovered and put in order. This need will subsist in greater or less measure for each experimental science as a whole, and especially in its infancy. The second of these necessities is that which arises in the remote and complex developments of some phase of a science when one wishes to branch off rather widely from the beaten trail and to develop a new chapter or section of the science.

It is not our purpose to consider the logic of discovery outside of the domain of the exact sciences nor indeed to discuss the variety of heuristic logics suited to the various sciences or their several parts except in so far as this may be convenient in analyzing the general character of such logics. From the example which we have exhibited from mathematics it must be clear that a logic of discovery may be special to a particular well-limited class of closely related problems and hardly have a point of contact with any other investigations whatever. Other examples with the same character can be found in mathematics, especially in those fields where the physical intuition can be brought to bear upon the mathematical problem, as in the theory of differential equations (ordinary and partial) with boundary conditions. It seems likely that this relativity of the logic of discovery to the particular subject matter of investigation will be found to be a characteristic of it in all divisions of science.

The tentative nature of the logic of discovery allows room for an error of a dangerous sort. In some cases the measure of sagacity required in the successful use of such a logic is not very great, and the investigator is therefore able to sense accurately a considerable class of results without a need for discarding any. His success for a time is

so uniform that he begins to lose sight of the tentative character of his processes of inference and to think of these as secure in the sense that they guarantee the validity of the conclusions attained. Then he gradually ceases to feel the need of a test of verification and is inclined to be satisfied without it, particularly if it is hard to devise such a test. He begins to have an undue confidence in his heuristic method. He has often found it successful. If it has ever led him astray he has seen clearly where he lacked in sagacity. In the new situation he seems to have avoided all extraneous sources of error. He concludes therefore that the result heuristically attained is valid even though he has not tested it independently.

It appears that an error of this sort is especially likely to arise in those domains of natural science in which one initially makes large abstraction of the actual complexity of the phenomena in order to bring them within the range of successful investigation.

Let us take an example of this, purposely put into extreme form in order to make the point clear.

Let us suppose that one is investigating the processes of thought. He examines all the observable circumstances connected with a process which yields a poem or an hypothesis in natural science or the consequence of some physical law or a theorem in mathematics. Waiving the question, for the moment, as to whether there is something hidden which he cannot see, he proceeds to make a complete catalog of all that he can find as he looks upon the thinker while in the process of thought. He varies the individual under investigation and the circumstances under which he is examined and the subject matter of his meditations. After a time he has a large number of facts of observation. Testing them for common properties, he finds that every one of them is of the nature of a physico-chemical fact. They are the sort of thing which the careless observer

might call the physico-chemical concomitants of the processes of thought. Our investigator is too careful to name them in this way; for that would already be to read into the observed facts a large measure of deep-lying hypothesis, and it is desirable to avoid this lest we read our prejudices into the facts. The subject whose processes of thought are being investigated will not be asked to give an account of his own experience; for, in doing so, his prepossessions will necessarily color his account. The matter must be made more thoroughly objective than would be possible under such a plan of procedure. The observed facts are before the investigator, shorn of everything which might be colored with prepossessions. They are all physico-chemical in their character. In how far may they account for the processes of thought? For each recorded movement of the thought process there is a physico-chemical phenomenon. What is the connection between them? In how far can one describe or explain the processes of thought in terms of these physico-chemical changes? These are natural and legitimate questions.

Let us suppose that a very considerable success has been attained in setting up a definite one-to-one correspondence between isolated items of thought and particular physico-chemical changes, so that one may measure certain movements of the physical frame and tell the subject truly at least a part of what he was thinking at the moment. As the work proceeds the investigator becomes more successful in recording the thoughts by means of the observed reactions of the physical frame. He begins to raise definitely the question as to how far he may go in accounting for thought in terms of physico-chemical changes and (let us say) he begins to incline to the view that a complete success is possible. In his meditations he begins to say to himself that if there is anything in the thought process besides these physico-chemical changes then that part of it

cannot be subjected to scientific investigation. A long experience with the matter inclines him more and more to identify these physico-chemical changes with the thought process which he started out to investigate; and he is led finally to assert the identification.

This case I have purposely made extreme; but I find it difficult to tell how far our psychologists have gone in this direction. Some of them have gone quite far enough to leave me bewildered. They seem to have laid aside some of the fundamental elements in the problem and to have neglected the fact that they have done so. Or have they merely delimited the field of "psychology" and left the study of the mind, in the older sense, to philosophy or to some science not yet created?

If I seem to have departed from my subject of the logic of discovery I wish now to come back to it and to say that it is legitimate to make any tentative abstraction of elements whatever that may seem desirable in a particular investigation, provided that it is always remembered that such abstraction has been made. It is desirable to know in how far the processes of thought can be described and explained in physico-chemical terms. But it is undesirable to allow the success in establishing the correspondences between the two things to obscure the fact that the style of the investigation necessarily leaves out of account entirely a certain type of phenomenon, and that it therefore throws no light on the question of the existence or non-existence of this type of phenomenon.

It has been said that "the greatest discovery ever made in philosophy was that the way to discover whether a thing is present is to look and see." In ancient times the exponent of this doctrine was Aristotle, while Francis Bacon brought it to clear notice in the modern world long after Telesio and Roger Bacon had unsuccessfully insisted upon it. But, as applied to external nature, the doctrine was

not in good repute with Plato who considered it erroneous and upheld as true that which agreed with his sentiments of propriety and beauty. Since the latter were supposed to have been ascertained by looking inward upon the mind this process of introspection finally came into disrepute because it led to contradictions with what was found by looking upon the external world to see. This disrepute of the practice of looking inward has been so great that some psychologists seem to have become afraid to use in their science as a method of discovery the simple one of looking and seeing. Their logic of discovery, so some of them seem to insist, must be one of induction from the observation of physico-chemical phenomena. To an outsider they seem to be in need of finding out again that the way to discover whether a thing is present is to look and see, at least in matters pertaining to the experience of concentrated thought. Their logic of discovery seems to have been made too narrow.

This narrowing of the range of the logic of discovery is not peculiar to any one science. It seems to me to be an ever-present danger in the necessary form of the process of discovery in any natural science. We cannot deal at once with the whole complexity of phenomena. We choose a certain part of them and try to find our explanations in terms of that part. It is always admitted that complete explanations have not been found; but that failure is accounted for by an insidious error common in what I would like to name the proof by ignorance. It is likely to arise when great abstraction has been made and this fact has been ignored. A good example of it in a general situation is afforded in condensed form by the following quotation:

"If, then, it is impossible, through deduction beginning from the transformist hypothesis, to build a theory of morphological evolution verified by experience, this is not be-

cause the hypothesis is false; it is because it is incomplete and corresponds solely to certain factors of evolution. In order to foresee the results it is necessary to know all the factors. The apparent indetermination arises solely from the insufficiency of our knowledge."

"The apparent indetermination arises solely from the insufficiency of our knowledge." Here in a single sentence is the essence of the proof by ignorance which in one form or another is often advanced in scientific discussions and sometimes treated in a dogmatic way widely variant from the spirit of true science. If one is to maintain the method at all he will probably have to do it merely by dogmatic assertion; for there does not appear to be any argument in its favor. It should be apparent to every one, on reflection, that we can never prove any positive proposition, any significant truth, by means of our ignorance of the facts in the case—except the one fact of our ignorance. When it is said in the foregoing statement that "the apparent indetermination arises solely from the insufficiency of our knowledge" the truth of this cannot be known from our knowledge of the facts, for we are confessedly ignorant of them. Three possibilities arise then: either the truth of the statement is not known at all; or it is known by some transcendental insight into external phenomena; or it is known through our ignorance of the facts. There is no room to doubt what the scientific conclusion is in the matter: the statement is not known to be true. It is neither demonstrated logically nor verified experimentally.

Perhaps we should dwell still longer upon the absurdity of this proof by ignorance, for it contains the essence of frequent error which vitiates many conclusions. W. K. Brooks in his *Foundations of Zoology*, truly says: "The hardest of intellectual virtues is philosophic doubt, and the mental vice to which are most prone is our tendency to believe that lack of evidence for an opinion is a reason for

believing something else." In the absence of any evidence that the indetermination is not due to our ignorance we are inclined to conclude that that is the ground of it. The second law of thermodynamics rests on just such insecure foundations. We know no facts to dispute it; we are far from having established it. The present situation warrants our taking it as an hypothesis to see what we can get out of it; but it does not justify any uneasiness of mind as to what it may say about the future history of the universe. The principles of the conservation of energy and of the conservation of mass, or their modern combination into a single principle, may well serve as a working hypothesis. But we must remember that no conclusion based on an hypothesis of such a character carries with it its own validity. Such a logic of discovery requires to be supplemented by an independent test of the result; and the latter may be accepted only provisionally in the absence of such a test.

There is something finer in a possible logic of discovery than anything which we have so far made explicit. One may arrive at truth not only by induction and deduction but also under the impulse to realize directly an ideal as to the form of the truth to be attained. The most striking recent instance of this is found in the general theory of relativity as developed by A. Einstein. In order to bring out clearly its character in this case we shall have to present certain elementary considerations associated with one aspect of the theory of relativity.²

Let us approach the matter by thinking of a geometrical curve fixed in the space interior to a given room of four walls meeting at right angles. If we take the floor and two adjacent walls to be a system of reference by means of which to locate the positions of points in the room,

² By taking the technical mathematical terms in their usual non-technical sense the non-mathematical reader will have a sufficiently clear idea to make the argument intelligible.

then we can uniquely define the position of a point on our curve by giving its distance from the floor and from each of the two walls selected. If the point moves along the given curve then the numbers expressing these distances will vary and will be related according to a law determined by the shape and position of the curve; these three variable numbers will satisfy certain equations of condition. Now suppose that we modify our procedure by using the ceiling and the other two walls as a system of reference. Since the relation of the curve to this system of reference is in general different from that to the former we obtain in general different equations of condition for the same curve. These conditions for the same curve would be modified still further if we should choose some other set of three mutually perpendicular planes for the system of reference, and especially so if these planes should be oriented in some new directions.

It is clear that the properties of the curve itself have in no wise been affected by these changes in the system of reference, even though we have several times modified the mathematical expressions by means of which these properties may be most compactly and most completely described. Let us for a moment forget these systems of reference and consider the curve itself by passing along it from point to point. Two characteristics will force themselves upon our attention: The amount of bending of the curve as we pass along it, its curvature; the amount of twisting of the curve, its torsion. These are intrinsic properties of the curve itself, capable of representation at each point on it by definite numerical values. These numerical values can be expressed in terms of the three distances pertaining to any given one of the systems of reference mentioned above; it turns out that definite rather simple formulae exist for expressing the curvature and torsion in terms of the named measurements. Since these describe

intrinsic properties of the curve their values must be unaltered by the transformations of variables due to the changes in the system of reference; that is, they must be invariants of the transformation.

Thus it is seen that the analytic expressions for the curvature and torsion are unchanged in form and in value as we pass from one of our systems of reference to another. It can be shown that they completely determine the intrinsic properties of the curve. Then we have in them a complete mathematical description of the intrinsic properties of the curve in a form from which we have abstracted those peculiarities which belong to the special system of reference by means of which we described the curve and its position in the first place. This sort of abstraction is of frequent and important use in mathematical investigations. It affords one of our methods of excluding from consideration those things which are irrelevant to the central purpose of the investigation and of fixing attention upon those things alone which are unaltered by, or are invariant under, the transformations permissible among the elements in consideration. A similar but extended use of invariants gives substance to the ideal which guided the development of the general theory of relativity.

Two considerable extensions are necessary before we can realize precisely the situation in the development of the Einstein theory. The first has to do with a generalization of the system of reference. We must replace the three mutually perpendicular planes of our system of reference by three warped surfaces, perhaps twisted and corrugated and irregular in shape and restricted only enough to allow us to utilize them successfully for the unique location of points in space. By means of these we are to describe the space configurations with which we have to deal. The other extension consists of the introduction of time into our system. We cannot well develop the mechanics of

three dimensions by means of what is merely geometric in three dimensions; but if we introduce time and think of our space-time continuum as affording a four-dimensional world, then our mechanics in three dimensions is replaced by a geometry in four dimensions. In the Einstein theory one no longer tries to maintain the separation of measured space and time; they are not independent; they are indissolubly united into a four-fold space-time extension. In this space-time of four dimensions we are to choose as a system of reference four warped three-dimensional spaces by means of which the location of points in this four-dimensional space-time shall be defined. We can go from one such system of reference to another by a change of fundamental variables. The totality of these changes is said to form a group, and certain subsets of them are called subgroups.

With these conceptions in mind, it is easy to make clear the nature of the ideal upon which Einstein insists as to the character of the laws of nature. He wishes to have them expressed in such form with respect to this four-dimensional continuum that there shall be no change in the form of these laws when we pass from one of these systems of reference to another, the mathematical relations expressing the laws are to be invariant when all quantities involved are changed in accordance with a transformation from one system of reference to another; let us say for convenience that the laws are to be stated in covariant form. When we have put them into such form we have abstracted from the statement of them everything which pertains to the particular system of reference employed.

It is a grave question whether the laws of nature are capable of formulation in accordance with the requirements of such an ideal; and an affirmative answer can be maintained only after a searching examination. All precise

evidence which exists up to the present time is in favor of the conclusion that such an ideal may be realized.

It is not necessary to our present purpose to go into a further analysis of the question as to whether this ideal may be realized in practice. We wish to look upon it as affording an example of a logic of discovery. One here sets up a certain ideal as to the form of the laws of nature. He then takes those known laws which agree closely with experimental facts and enquires whether their statement meets this ideal. This affords the best way to make trial of the validity of the character of the law which his ideal would impose upon nature. If the law as previously conceived meets this ideal there is a certain satisfaction, but there is nothing further to be done with this law. The investigator passes to another in order to discover, if possible, one which is not yet subject to this ideal. Suppose that he finds one, as Einstein did in the case of the Newtonian law of gravitation. It turned out that this law does not accord with the ideal of covariance of the laws of nature. Shall one then give up the ideal on the ground that the Newtonian law is so well established that any deviation from it required by a new ideal shows that this ideal is not realizable? No, not on this evidence alone; it may be, after all, that the law of Newton is not exact and that some modification of it will bring it into covariant form without disturbing its agreement with observed facts. If so, there is likely to be some range of facts, perhaps not previously observed, in which the two laws will give measurably different results; and one will then have a crucial experiment by means of which to discard one in favor of the other.

As a matter of fact, the Einstein theory appears to have triumphed over the Newtonian theory in precisely this way. Whether it has or not is not essential to our present purpose. We are concerned with the heuristic logic in-

volved in the process. In accordance with the Einstein demand it is desirable to enforce upon nature, if possible, a certain ideal as to the mathematical form of the statement of the laws of nature. This ideal guides one's investigations and leads to conclusions as to laws of experimental phenomena. It does not prove these laws; for we have not yet any means of knowing that the laws of nature are capable of expression in covariant form. But it does give us certain new laws, or modified forms of old laws, which we would probably not have reached except under the guidance of such an ideal. The ideal thus gives rise to a logic of discovery. The supposed law once attained is subjected to a searching test. If it survives under this test, then we have a veritable advance brought about by the guidance of an ideal which affords a heuristic means of inferring the unknown from the previously known.

According to this aesthetically satisfying ideal of Einstein, then, we are to have in the mathematical form of the laws of nature a complete covariance under the general group of transformations of coordinates in the four-dimensional space-time continuum. But in the complete realization of this ideal there are certain difficulties of the nature of mathematical complication the avoidance of which would be welcome. The question, then, arises naturally as to whether we might not take certain subgroups of the general group of transformations and apply these to the separate fields for the purpose of obtaining approximate laws—laws which are covariant under the subgroup applicable to a given field or under several subgroups of a given type. Perhaps one may not have as strong expectancy of the validity of such a law as of one which is wholly

covariant; nevertheless one may naturally expect in this way to make closer approximations than he would make without this aid.

This is a new sort of approximation in theoretical physics of a much more profound character than numerical approximation. It is an approximation in the sense demanded by covariance under a subgroup instead of under the whole group. As the subgroup is enlarged, and the statement of the law undergoes consequent modification, the approximation will presumably become closer and may even become as close as is needed for agreement with experiment even though the entire group of transformations is not employed.

The group of the Lorentz-Einstein transformations of the special theory of relativity is precisely such a subgroup as we have just described; and it is well known how it has led to more satisfactory theories of certain phenomena than those which had preceded them. Under this group the Maxwell-Hertz electrodynamic equations and the wave equation deduced from them are invariant. Now, if all the phenomena in a certain field are invariant under this transformation group then every mathematical formulation of law in this field should be in the form of an equation which is covariant under this group. This would afford a precious guide as to the necessary form of such an equation. If an equation is obtained in an empirical way, then one considers it only as a rough approximation to the true equation; and one seeks a better form of it which shall have the two properties of being invariant under the named group and of being represented to a suitable approximation by the empirical equation first obtained.

It seems not unlikely that each large and well-defined class of phenomena may have associated with it a certain group of transformations—a subgroup of the general group of transformations of axes in the four-dimensional space-time continuum—of such sort that the phenomena in question (or at least the most of them) may be represented to an approximation quite within the range of experimental error by requiring merely that modification of approximate empirical laws which is required to bring them into a form that shall be covariant under the given subgroup of the total Einstein group.

This procedure might well have the advantage that it may be carried out much more readily than the corresponding one based on the original group, at least if the subgroup is of simple character, say analogous to the group of all multiplicative linear homogeneous transformations.

From certain mathematical considerations it seems probable that in many important cases one would actually obtain in this way precise laws the covariance of whose statement under the general Einstein group could be readily established. The number of invariants relative to a given subgroup and agreeing with a given rough empirical law to a suitable approximation may often be small or be even unity. In the latter case it must be the law which is covariant under the general Einstein group, if there is such a law. In the former case, one would probably have little difficulty in choosing the appropriate one for general covariance (if such a one exists).

Thus it seems likely that a systematic study of the covariance of laws under subgroups of the general Einstein group will lead to useful means of discovering the

laws of phenomena. Thus for each of these subgroups we appear to have the possibility of a logic of discovery of the same general sort as that employed by Einstein in his general theory and differing from the latter only by virtue of its being relative to a subgroup of the Einstein group instead of to the whole group. Thus it seems probable that we may have in physical science a considerable variety of logics of discovery based on transformation groups as the ultimate ground under the ideal as to the form of statement of the laws. Of course, every law obtained in this way (as well as in any other) must be subjected to experimental test before it can be accepted. The method would profess only to help in discovery. Some of the results to which it would lead would turn out to be valid (if the general theory of relativity is valid) and others would need further modification under the guidance of a more comprehensive group.

Let us give a brief summary of the foregoing discussion:

It is conceivable that in the nature of things the mind is unable to comprehend its highest movements with clearness and also that certain of its acts of discovery are essentially creative in character; but neither of these possibilities need affect the development of a logic of discovery in the sense of a logic by which one infers from the known to that unknown which hitherto has not been apprehended or suspected. Such a logic may lead forward by well-defined steps to clearly ascertainable propositions without carrying with it a demonstration of those propositions. The already developed systematic logic is a logic of demonstration. The logic of discovery, in the higher sense of

the term, has no existence as an actually developed science. This was insisted upon in effect by Descartes and Francis Bacon and remains as true in our day as in theirs. Bacon's supreme effort to found a logic of discovery ended in failure. No single discovery can be pointed to which can be definitely ascribed to the use of his rules.

There are two causes which may have contributed to this failure. It is conceivable that the primary acts of discovery are so essentially creative in their character that no science of inference from the known to the unknown can be developed; or, if it can be developed in part, that it cannot be adequate except in a very restricted range. This does not seem to have been the main difficulty. The conception of the logic of discovery as a unit, comparable in unitary character to the logic of demonstration and scarcely separable into parts, has, I believe, been a chief hindrance to its development. We can have not so much a logic of discovery as logics of discovery each relative to some field or subject matter of investigation. Discovery is relative to the point of view. We can no longer proceed as Descartes did when he "thought out what the constitution of the world and man must be if they were to be clearly understood."

The essential step of discovery is in the formation of a conjectured proposition to be tested or of an hypothesis out of which the proposition comes or of an ideal which guides in the formation of both hypothesis and proposition. It is possible that truth may be discovered by means of a logic which carries with it the demonstration of the truth; but the more characteristic logics of discovery are merely suggestive in character. The former is often illus-

strated in mathematics, particularly in the theory of numbers and the theory of finite groups. In physical science it is the latter which is generally in evidence. This latter also has a wide usefulness in mathematics. Every result of a heuristic logic must be subjected to some suitable adequate test after it is obtained. In mathematics it is often demonstrated by a *de novo* argument. Such a heuristic logic serves the three-fold purpose of making the problems definite, of suggesting the central theorems of an investigation, and of indicating suitable methods of proof.

The tentative nature of logics of discovery allows room for an error of a dangerous sort. When the measure of sagacity required for the use of such a logic is not great one may so uniformly succeed with it for a time as to lose his sense of the need of an independent test of the result. By hidden gradations of error one may then pass step by step to the condition of being satisfied with the unsound "proof by ignorance" so that he is able to conclude an argument with the absurd climax: "The apparent indetermination arises solely from the insufficiency of our knowledge."

The finest thing associated with a logic of discovery is that one may arrive at truth under the impulse to realize directly an ideal of far-reaching importance as to the form of the truth to be attained. The most recent striking instance of this is to be found in the general theory of relativity. In accordance with Einstein's demand it is desirable to enforce upon nature, if possible, a certain ideal as to the mathematical form of the statement of the laws of nature. This ideal guides investigation and leads to new laws. It affords a heuristic logic associated with a general

group of transformations in space of four dimensions. It seems probable that certain related but more special logics of discovery of distinct usefulness may be associated similarly with certain subgroups of this general group and that we may thus have in physical science a considerable variety of logics of discovery each based on a transformation group as the ultimate substance of a related ideal as to the form of statement of the laws.

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CRITICISMS AND DISCUSSION

SPRENGLER'S THEORY OF THE HISTORICAL PROCESS

OF MAKING many books there is no end, but of selling and even of reading them the end is often speedy, if indeed there was any beginning. Only now and then there appears a fateful volume, that seems to fall from the sky, from "the chill bosom of the desert air," which an age, a generation, a people at once recognizes as its own, as the large utterance of its inmost soul, and proceeds to appropriate, to assimilate, to embody in its own life and aspirations and destiny. Such a work, "sky-descended" like the Artemis-image at Ephesus, has now for over a year possessed the consciousness of Central Europe and filled it with amazement and awe. Whether it will finally establish its possession and mould the mind of the people into its own likeness, it is of course too early to say; but not too early to take the measure of the work itself, to set forth its central contentions, and to appraise their scientific and critical value.

The book in question is Oswald Spengler's, *Der Untergang des Abendlandes*, and in the beginning it must be admitted that only the first volume has reached the present writer. The tabulated contents of the second volume, however, do not promise any notable expansion of the wide horizon of thought already disclosed in the first, unless perhaps in the closing chapter, on "Russia and the Future," to which one must look forward with the keenest interest.

The title of the work, *Downfall of the Western World*, is certainly inadequate, nor does it so much as hint the essence either of the matter or the method of these pages; it merely indicates the alleged trend and issue of the historic process that Spengler claims to have discovered and identified and has certainly illuminated with

extraordinary splendor of scientific and philosophic, mathematical and historic, political and socio-economic learning, while at the same time interpreting with almost demonic skill in combination and depth of insight. Such, indeed, is the loftiness and aloofness of the author's spirit, that it seems strange beyond measure that his work should have made any popular appeal whatever, and it is a perpetual wonder, who buys the book? and still more, who reads it? For Spengler does not stoop to his readers; from beginning to end he seems to hold communion with himself on the Andean summits of the most recent mathematical, philosophical, archeological thought; like Nietzsche he might boast, and with far better reason, to "have sought the heights where blows the keenest air, and few there be find breathing easy there." Continental, in truth, is the range of his vision, reaching from Minkowski to G. B. Shaw, from the Entropy of Clausius to the counterpoint of Bach and Beethoven. The work may indeed have tendencies, but it seems singularly free from sympathies or human feelings. Apparently it might have been written by a Russian, or a Frenchman or Turk or Prussian, or even an Italian, nay even by an Englishman; if the author inclines at all from the vertical of impartiality, it would appear to be toward Britain or Egypt and away from Athens and Rome. More than all, however, he seems to resemble some piercing intelligence, from Mars perhaps, who has visited many planets and reports upon them all without hate and without love, unmoved as the "breast of some stone Dian at thirteen." If he has any passion at all, it is apparently for the Infinite Space of the Nordic Culture, for the intricate harmonies of Bachian music, for the stony simplicity of Egyptian art, for the character-drama of Shakespeare, above all for the poetic-philosophic mind of Goethe and its profound morphologic interpretation of Nature. If he has any pet aversion, it is seemingly Darwin and Haeckel and the jealous finity of the classical soul. Often he complains of the hopeless hardness, petrifaction, and death of the "world-city," of the cosmopolitan spirit, and one is tempted to wonder if the modern malady has not infected himself.

What then is the plan and aim of his volume? It is an interpretation, one might almost say a philosophy, of history. At this term the forms of Hegel and Buckle and Guizot and our own Draper and a host of others start from their slumber in the unconscious and float forward into light, but Spengler is not in line with any of these. Not one of them, significant men though they were, approached his

task with the rigorous technical equipment and mastery of Spengler. In particular, they rather deprecated or neglected mathematics, to which Spengler is by vocation devoted and if not the lord of all its subtleties—as who can be?—he is at least at home in its highest regions and possessed of its daring spirit. Neither did any of his elders follow either the idea or the method of Spengler, both shadowed forth in the subtitle—"Outlines of a Morphology of World-history." He might indeed have inserted an adjective and called it Comparative Morphology; for he seems to contend that there is really no unital history, no career of Culture, but only many histories of many individual cultures. And here indeed by over-accent he is tempted to fall into unfortunate Pluralism and to lose hold of the Oneness of the world, which his adored master Goethe not only recognized and expressed, but would seem also to have felt even keenly. A Culture may indeed undergo fission like a protozoön, and some developments of the individual may outrun others in time, and so present the aspect of several cultures, but surely this does not overcome the fundamental unity of culture as a whole. That there is some One called Man, at least the Antique, the Egyptian, the Nordic Man, Spengler himself attests in speaking of their cultures as units, as expressions of different Souls, as living definite lives and moving forward to definite ends. But these expressions were each through countless millions of men; if this multiplicity did not attain the unity of the cultures, why should still further multiplicity, or any cleavage of men into Races, attain it? Indeed, the comparative morphology of cultures is implied in the whole process of our author's thought. In every chapter, in almost every section, he is comparing some "stadium" of one culture with some "stadium" of another, identifying or contrasting the two, and this has no meaning unless there be some deeper unity of the cultures themselves; just as it signifies nothing to discover homologous organs in fish and birds, unless this points back to a primitive unity of pattern which the fish has realized along one line of growth and the bird along another. Of course, our author has not forgotten this, he indeed dwells upon the distinction between homologous and analogous, but he has not duly weighed all the implications, and has stressed unduly the severality of cultures—a want of proportion that avenges itself by vitiating measurably his final conclusions.

To return, what then is the author's main conception of Culture? The answer is that Culture for him is the realization of Soul-

possibility. In fact, Soul is for him "that which may or can be." In this realization he distinguishes anxiously if not always clearly between the process and the result, the Becoming and the Become. It is the former that constitutes Culture proper; the latter is civilization rather, which is really the consummation and death of Culture, the arterio-sclerosis of history. Much of this seems to hearken back to Goethe. The author conceives of culture as a growth, an organism, a plant that springs up from the soil,¹ and lifts and spreads its leaves and fronds and branches, and buds and blooms and waves all its splendor in the wind, and then fades and withers and falls back to earth. But the analogy does not hold throughout; for the plant scatters not only its leaves but its fruit, its seeds, upon the earth and renews itself in the next generation:

"Leaves now sheddeth the wind on the earth, now others the forest
Buddeth anew in its bloom, when the spring-tide season appeareth."

But there is no recurrent spring for Spengler's Culture; once petrified or moribund in Civilization, its career is accomplished. However, men are actually like leaves:

"So generations of men: one passeth, and cometh another."

Possibly it were more just to Spengler to say that he regards a Culture as the budding, fruiting of a single branch on the great tree of Humanity, and Civilization as the fading and fall, the tree remaining to weave anew its songs of spring—but only on another branch. Again the image is imperfect. Any satisfactory theory of history should certainly take into consideration that men continue to inhabit this planet long after their culture has become rigidified and (according to Spengler) dead in decadent civilization. But for him they have no interest, he passes them by without notice; yet, interesting or no, they actually are, and they must in some way be fitted into the general scheme of history and historical theory. It is a serious delinquency of Spengler's that he makes no place for these multitudes. The continuity of history suffers violence at his hands.

But we must come closer to Spengler's notion of the Culture-Growth. Strive as we will, we cannot escape philosophy or even

¹ A Culture effloresces on the soil (*Boden*) of an exactly definable region (*Landschaft*) on which it remains bound, like a plant." "The classic soul (*Seelentum*) was born about 1000 B. C. of the region of the Aegean Sea."

"The Arabic Culture springs wholly from the bosom of the region between the Nile and the Euphrates, Cairo and Bagdad." . . . "The trend to the Infinite (and so to the Faustian) slumbered deep in the Northern region, long before the first Christian trod it." But Spengler makes little or no attempt to relate the characteristics of the Culture to the peculiarities of the parental "*Landschaft*."

metaphysic. Hartmann is right in avowing (*Kategorienlehre*, xiii.), in defiance of prevalent prejudice, that for him at least the centre of interest still remains in metaphysic; and our author commends his work by his frequent implication of a thoroughgoing Idealism (some might say Relativism rather). From no other viewpoint is interpretation of human history possible; from none other can a discussion of Values, of the great achievements of Man, of Art and Science and Literature, be even attempted. For Spengler, then, the active element in history is the human Soul or Mind or Spirit (there is no strife about words), which grows and struggles to express or objectify itself continually in all manner of forms, in Space and Time, in Percepts and Concepts, in Numbers and Diagrams, in Algebra and Geometry, in Analysis and Logic, in Physics and Metaphysics, in Architecture and Sculpture, in Painting and Music, in Literature, in Commerce, in Religion. One and all these are regarded as creations, as outputs of Culture-Soul.

If now we ask more closely what is the typical career of a Culture, the answer is that Spengler has given no formal and satisfactory statement, but on comparing a number of detached sayings he appears to conceive of a Culture as implicit in the racial soul inhabiting a certain definite region and bodying forth at birth a formless half-conscious mysticism, a cloud-land of dream experience, for which our sophisticated tongues have few or no symbols; as the Soul lives and grows it passes into the child-stage of myth-making, projecting its colossal creations upon the screen of folklore and poesy; advancing through youth into maturity it evolves its forms of philosophy and monotheistic religion and unrolls the rich tapestry of its art: its architecture, its sculpture, its monuments, its painting, and its music; in the days of its full strength it perfects and even begins to conventionalize all these, it develops a comprehensive and aggressive science, it systematizes and rationalizes both philosophy and religion; later it veers toward the arid regions of Materialism, it begins to lose the elasticity, the exultant bound, the joyous note of youth and early manhood, it adopts the steady stiffening step and the sobering hues of Age; now at length it has done its work, it has wrought out its Culture, it settles down into the rigidity and formalism of accomplished Civilization, it closes the cycle of its strange eventful history. Meantime it has elaborated many abstract Ideas, such as Time, Space, Number and others less mathematical, and it is on such that Spengler has delighted to exap-

tiate in contrasting the various Cultures. Thus he finds that the Egyptian Soul has fairly reveled in developing depth, the third dimension of Space. Its symbol is the Vista ("der Weg"). It ranges its figures in endless processions—on, on forever march its corridors of kings and gods and men and sphinxes. One is led to ask whether the Nile has not done its part in bringing to birth this child of the Egyptian Soul? The Greek or classical Soul realized its space-striving in the bounded Body, the definite form, whether of statue or temple, of drama or of state, of poetic measure or of Euclidean geometry,—and perhaps no other realization in history has been so nearly perfect. We naturally inquire, has the dominance of the Boundary in classic culture any connection with the narrow circumscription of the Isles of Greece?

The Nordic or modern Soul has burst the classic bars; it is possessed by restless yearning for the Infinite; its Space, like that of the opium-eater, swells to unimaginable dimensions, it projects titanic systems of mathematics swinging like a pendulum between the infinitely great and the infinitely small, it opens up ever widening perspectives in painting, it sounds unfathomable depths in astronomy, it dissolves the universe into limitless oceans of harmony in the polyphories of Beethoven and especially of Bach.

On all these and many other related themes, Spengler is intensely interesting and often illuminating, though not always convincing. In particular, he tells us nothing about the pre-natal pre-mystical phase of the Culture-Soul,—and yet such there must have been, if not a Soul performed, at least the preformative elements of a Soul, gathering on the "Landscape," as that wisp of cloud now gathers on the blue of the sky. Here, indeed, we stand at the parting of the ways, and it seems regrettable that Spengler has not more formally ranged himself in the ranks of positivistic Idealism, where he certainly belongs, as many dicta scattered through his volume attest (e. g., pp. 222ff., as "to be sure, man is an atom in the universe, but the universe at the same time is the product of his reason." . . . "This soul, and indeed the soul of each individual that experiences in itself the whole world of historic event and *therefore creates it*, etc."). But a Materialist, or at least a Realist, might grant many of his contentions and still think of the Culture-Soul not as a creator but only as an explorer amid a wholly material objective and independent world, as discovering a variety of relations among a "variety of things," things and relations that were

in full force before his own arrival on the scene, and are inappreciably affected by his presence, and will endure with perfect composure his early departure. He would say that such a mere observer and his race would also develop a culture of this kind or that according to the nature of the man and especially according to the nature of the milieu, of the object-world in which he finds himself immersed. Such a Realist would relate the peculiarities of the Greek culture in great measure to the geography of Hellas, to its pellucid air, its myriad-smiling seas, its rugged mountains, its mysterious glens, its marble quarries, its sparkling streams. He would try to state Homer and the Iliad, Plato and the Republic, Phidias and the Parthenon in thermo-barohygro-metric terms, even as Taine correlates Shakespeare, Milton and the rest with the snow and foam and tempest of the low-stretched North-Sea shore, and its low-hung clouds swart under heaven, its starless skies, its short fierce summer, and its winter without end. In the hands of a Buckle such an explanation may attain a momentary plausibility, and we are not able to deny that such or indeed any environment may modify more or less, may shape and tinge the outward projection of the inmost Soul. But any profounder influence is unthinkable, and the materialistic interpretation of history leaves it in the main uninterpreted. Burns may have sung of field mice and Highland Mary and chill November and Saturday night rather than of olive groves and tournaments and April skies and cathedral aisles, because he was a peasant of Scotland and not of Italy or Provence, but no amount of environment will ever explain why he sang or felt at all.

But has Spengler anything better to offer? And here it must be confessed that logical rigor is not the *pièce de résistance* in this author's work. His thought is amazingly abundant. Throw open his volume anywhere, and ideas seem to fly forth like birds from a magician's basket; but he is at no great pains to order them aright in firm irresistible phalanx; he lets them loose to our delight and amazement, but he lets them wander as they will if only their general direction seems not away from the lines of his thought. Spengler hardly suggests that climatic or other external influences have moulded in any measure the cultures of which he speaks.² Of these there are two, the Nordic or Faustian and the Antique, classic, or Apollinian (a borrowed Nietzschean term) that interest him most as polar opposites; in less degree the Early Arabic or Magic (which includes the Hebrew and early Christian) and the Egyptian com-

² See note, p. 7.

mand his attention, while the Indian and the Chinese receive only occasional mention. The Renaissance is elaborately treated but not as a single original impulse, rather as a hybrid resultant of Antique and Magic and Nordic confusion. Such is the group of Cultures whose birth, growth, consummation and final mummification constitute the history of the circum-mediterranean world from Thebes to London, from Poland to Spain. Each of these Cultures is the Striving of a Soul for the most part unconscious, that incorporates itself in countless individuals simultaneously and successively and bodies itself forth in Symbols on Symbols in every art, every science, every institution, every activity of man. What a shallow philosophy is prone to regard as the deepest realities of the outer world, the invariable verities of the universe, are only the elaborate symbols of this age-long spiritual unrest and life-urge shaping the symbols of itself into forms of various beauty and terror and awe. But these Cultures realize themselves independently. It is false and misleading to speak of ancient and middle and modern age. The last is not a continuation of the second nor the second of the first. The torch falls and is quenched; it is not handed on. The antique completed itself and filled its span and ossified in death. The early Arabic (or Magic) erupted as early Christianity upon the stage but in a measure was hemmed by the antique that lingered superfluous; then in the seventh century its high-mounting wave suddenly overflowed and surged with unparalleled speed even to the walls of Paris, where it dashed into foam; the Nordic or Faustian, Belgian-born, has flowered from the Vistula to the Tagus and now having reached its climacteric in Shakespeare, Napoleon, Bach, Gauss and their kin, it nods to its end in the men of machines, in Cecil Rhodes, Journalism, Socialism, skyscrapers and all the dead or dying Civilization of the World-City of today.

What reason has Spengler for this last diagnosis? If you observe the development of one organism, as a lily, from its sprouting to its fading and its fall, and of another very similar, and of still another, and then if a fourth one be watched carefully through various stages, you would doubtless declare with confidence at a certain point: *The sprouting, the budding, the blossoming have come and gone; the time of seeding and decline and death is near.* Such is the movement of our author's thought. From the examples of Greek, Egyptian, and Arab he discovers the life-process of a Culture; he then turns to the Faustian or Nordic and finds all the signs

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that point to a sad senescence. After all, then, it is only history teaching by example. A very impressive and yet it would seem a rather unprofitable method of instruction, if, as Hegel tells us, the great lesson that history teaches is this: that we never learn what history teaches. How, indeed, should we, if the analogy of the plant must really hold good? In that case the scheme is all made out beforehand, it is all enshrined in the primal germ of the Culture-Soul, in what Spengler calls *Schicksal*,⁸ and Crile the hereditary "pattern." Circumstances (he would seem to concede) may indeed modify slightly but not significantly. France instead of Spain might have fitted out Columbus and have initiated the grand colonization. But are we quite sure the modification would have been slight? Who knows what might have happened? We cannot appeal to the plant-analogy to prove more than it really proves. Analogies are valuable—stimulating and highly suggestive—but their logical worth is not great; from resemblance between some relations we may suspect but cannot infer a resemblance between others. Besides, the inductive base in Spengler's reasoning is very narrow. The plants and other organisms whose life-careers have been observed are countless; not so the cultures; even a crow can count three. Moreover, the conditions have undergone profound variation. The Greek and Egyptian developed comparatively freely, in almost complete isolation; the Arabic was balked at the start, but finally burst forth with prodigious urge, only to meet with restraint and repression; the Nordic alone has gone on conquering and to conquer, absorbing energy from without while expending it from within, striking ever wider and deeper roots into the mold of centuries, populating new continents and assimilating old-world forms outworn. If the elder cultures were annual plants, is it not barely possible that the Nordic may prove to be a perennial,

. ein starker Baum
 Der ein Sommertausend lebt,
 Nach verträumten Winterstraum
 Neue Lenzgedichte webt?

This would not offend against our author's just and central idea that a Culture is a growth, a realization of Soul-possibility. But it would recognize another idea that he has unduly neglected, the idea of the Communal Soul. He indeed tells us clearly enough, though it will bear exceeding emphasis and repetition, that each individual

⁸ Compare the similar pronouncement of Raymond Pearl in *Harper's* for May, 1921, p. 713: "Whatever the ultimate destiny of the universe it will unswervingly be carried out."

spirit makes its own world of Space and Time, that it builds up its own universe about it, which titanic Symbol has no existence independent of the Self that constructs it. Such indeed is the sure result of psychologic analysis and philosophic thinking, if there be any sure result at all. But it is not the whole story. It leaves quite unexplained the Time-and-Space uniformities of the symbolic world, which we call the Laws of Nature, a rock on which all crafts of pure Solipsism seem to wreck. The fact is that the great Symbol is social as well as Individual. The Constructive Souls are fundamentally one both at any given moment of time and through the long stretches of human and even planetary history. Each is a wavelet of the One universal wave. The individual human consciousness is not the final form to which Consciousness may attain. The Communal Consciousness Divine lies far ahead on the path that we are all stumbling along. It is the goal of history, if there be any goal, if we are not whirled on forever in an endless, unmeaning circle. It seems hard to look abroad upon the world of Mathematics and Painting and Music,—upon which Spengler has fixed such a penetrating gaze, discerning more clearly than any before him the all-pervasive urge to the Infinite,—or even upon the humbler worlds of Commerce, Industry, Politics and Society, and not behold how "the thousand-folded vault of Being with might combines itself in one." Is not such indeed the sense of Goethe's impressive lines, which form the motto to Spengler's book?

Wenn im Unendlichen dasselbe
Sich wiederholend ewig fliesst,
Das tausendfältige Gewölbe
Sich kräftig in einander schliesst;
Strömt Lebenslust aus allen Dingen,
Dem kleinsten wie dem grössten Stern,
Und alles Drängen, alles Ringen
Ist ewige Ruh in Gott dem Herrn.

Only in this Communal Consciousness, germinal as yet, lies the eternity even of mathematical truth, the meaning of morality and sympathy and love, as well as the promise and potency of "the parliament of man, the federation of the world."

Undoubtedly the undulation of history, the rise and fall of the wave of life throughout the world, is the most solemn and awful of all spectacles. Well may it fill the beholder with dismay if not with despair. If there is any refuge, any "asylum from age unto age," it must be found in this concept (which is also the logical

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necessity) of the Eternal Unity, so wonderfully shadowed forth in Goethe's verses:

And all the wide world's wild commotion
Is endless rest in God the Lord.

It cannot be that Spengler disclaims or discredits this notion, without which indeed all history would seem to remain forever unintelligible, but he has certainly not weighted it properly in the *Untergang*, else the general outlook of the work would have been quite another. It may be that we have reached or passed a crest of the great Nordic wave of Culture, but it does not follow that there will never be another great mathematician, or painter, or musician, or poet, or even sculptor. A trough may follow the crest, but another and even a higher crest may follow the trough. There is nothing in Spengler's masterly work to certify that the Nordic Soul has been exhausted.

The "world-city" is not the world. Capitalism, and Imperialism, and Socialism, may all be very unpromising, but they do not embody the sum total of the efforts, tendencies, and aspirations of the modern Soul. There may be, there are many others, many that we do not now recognize and cannot even name, germinal impulses that will gather strength from the years and effloresce at last in forms of truth and beauty as alien from Gauss and Bach and Shakespeare as they are from Archimedes and Phidias and Homer. "The world is deep, and deeper than the day can sound." Not even the thought of Spengler has plumbed its depths. Even if ennui or slumber overtake and overpower our present mathematics and philosophy, who knows when some new interest shall suddenly awake and arouse them like strong men to run a race? Though poetry and plastic and music may fall into triviality, who knows where the gods shall again pour out the sacred oil upon the altar, and lo! it shall leap into flame? The variety of Nature still surpasses the imagination of man. Nay, not even the all-dreaded Entropy, not even the "heat-death" of Clausius, need rob us of our trust and peace. If the steady degeneration of energy were doomed to end the world in uniformly distributed heat some day, why has it not done so already? Surely it has had time enough, it has had eternity—*ab ante*. Can it accomplish in eternity from now forward what it has failed to accomplish in eternity from now backward? Such chilling vaticinations as Spengler's,—perhaps not quite so chilling, but at least proclaiming *non plus ultra*, with awful solemnity,—have sounded forth at every sharp turn in the ascending path of human-

ity; but all the alleged demonstrations of the impossibility of further progress have been disproved by one and the same argument—by progressing further.

It is interesting and important to compare our author's notions with those of Flinders Petrie as set forth in his "Revolutions of Civilization," published in 1912, the year in which the "Untergang" was begun. Petrie is, of course, far less ambitious; he is chiefly concerned with constating and arranging the facts in the case; of the great body of Spengler—interpretations Petrie has never dreamed. Yet he agrees in the main idea of a natural life of a "Civilization," and in the further contention that we are approaching the last stages of such a life. Petrie's profound historic-archeologic investigations have revealed to him eight successive waves of civilization (culture) that have swept over the circum-mediterranean world. Of these the first two were prehistoric, and perhaps the less said of them, in our present ignorance, the better. The next two rose and subsided in the great Nile valley, but the second (the pyramid-building culture) overflowed into Crete, giving us the early Cretan civilization of the fifth millennium B. C. The fifth wave swelled up high in Egyptian and mid-Cretan culture, then sank in sudden ruin, all in the fourth prechristian millennium. In the sixth Great Year the Egyptian wave again lifted its crest, in the third and second millennia, while the Late Cretan shot up to towering heights, not surpassed if indeed since matched, at least in sculpture, and overflowed to Mycene on the continent of Europe until its dazzling splendor was totally eclipsed in the Dorian Invasion. The seventh wave rose feebly if at all in Egypt, but towered in broad, unexampled and many-crested glory over Greece and in less degree over Italy and other circum-mediterranean lands, as the well-known classic civilization culminating in Athens, 450 B. C. Thence, it sank by slow degrees for six hundred and fifty years, thence more swiftly to its deepest trough, A. D. 800. The eighth (or modern) wave rose slowly from the dark profound and broke into a number of successive crests, the first of which (in the Bamberg sculptures and the Salisbury Cathedral) it reached about 1250; the others have followed at unequal pace. Petrie finds that these successive crests of the same wave observe a soldierly order and multiply as the ages revolve. This order he finds to be Sculpture, Painting, Literature, Mechanics, Science, Wealth, and the lag (or hysteresis, as the mechanician would say) may reach nearly a thousand years. Thus of the classic wave the successive partial crests were reached

after lags, from the sculpture-crest, of 100, 200, 450, 600, 650 years, while the corresponding tops of the modern wave were attained about 1240, 1400, 1600, 1790, 1890, 1920—? But surely in no proper sense can Mechanics be said to have culminated in 1790 or even yet—as witness the airplane and wireless telegraphy and what not; neither will Planck or Einstein or Michelson admit that Science has ceased to mount since 1890. And as to Wealth, in spite of the vast destruction of recent years, it seems likely that in another decade the losses may all be made good and the average of human comforts be steadily increasing. While then there may be much that is just and illuminating in the Classification of Petrie and Evans, it is none the less clear that the facts of the modern wave will not fit into the scheme without violence and distortion. Petrie's work has many other very interesting *aperçus*, and it is distinctly cheering that he recognizes "the widening of the outlook in the summer of each period, and the amelioration of the collapse in the winter," whether or no "this is the real nature of human progress."

Spengler has also the notion of the "Great Year," with its Spring, Summer, Autumn and Winter, but not of a succession of such years wrapped in a spiral continuously round the axis of Time, in Petrie's striking but fantastic fashion; his scheme of history is arranged in "parallel series" of four chief cultures: Indian (since 1500 B. C.), Antique (since 1100 B. C.), Arabic (since A. D. 0), Occidental (since 900 A. D.). These four begin respectively with the Veda-Myth, the Olympic Myth.

Protochristianity (elsewhere called the Early-Arabic Myth), and Germanic Catholicism each reaching through three hundred years:—a period of splendid energy, of new-born sense of God, expressing itself in majestic myth and symbol, of *Weltangst* and World-longing, the age of the Aryan Hero—Saga, of Homer, of the Gospels and Apocalypse, of the Edda and the Nibelungen. A bold and impressive correlation, but it is certainly bewildering to find the "Gnostics" in the second half, between the "Neo-Platonists" and "Church fathers," when the "Gnosis" is now well known to have been proto-and even pre-christian; Spengler is considering only its degenerate and excommunicated forms, he has forgotten the Naassenes. The Summer is the glorious season of "Ripening Consciousness"; it begins everywhere with "Reformation" in Religion, with popular insurrection against the great forms of the earlier time; it passes over into the philosophic form of the World-feeling, into the Upanishads, the Pre-Socratics, the nameless heroes of

Syrian, Coptic, Neo-Persian thought (of sixth and seventh centuries), whose greatness only the Twentieth Century has begun to teach us, into Galilei, Descartes, Bruno, Bacon, Boehme, Leibniz; it is continued in the "New Mathematics" (*spurlos verseenkt* in India!), in the brilliant Geometry of the Greeks, realizing the notion of limited magnitude and number as its measure in the Arabic conception of Algebra and unlimited (unknown) number, in the Occidental conception of number as Function, issuing in the Infinitesimal Analysis; it closes in "Puritanism," a rationalistic—Mystic impoverishment of Religion, an intellectual fanaticism traceable in the Upanishads, in the Pythagorean League, in Muhammad, in the Puritans and Jansenists. The faint suggestion is in the air, of Approaching Autumn, the season of "Metropolitan Intelligence," attaining the apex of "purely spiritual formative power," opening in "Illumination," with Faith in the Omnipotence of Reason, with the worship of Nature, with "National Religion,"—the era of the Sutras (Sankhya), of the Sophist, and Socrates and Demokritos, of Nazzam, Alkindi, Alkabi, of Locke and Rousseau and Voltaire (and why not Diderot and D'Alembert?), marking then the culmination of mathematical thought in the Indian conception of zero and place-value and angular functions, in Plato and his mates, in unexplored Arabic researches in number-theory and spherical trigonometry, in Euler, Lagrange, Laplace; and closing in the great definitive philosophic systems of India, of Plato and Aristotle, of Alkarabi, Allaf, Avicenna, of Goethe, Kant and their continuators. Herewith Culture passes over into Civilization, centering its life in overgrown "world-cities," quenching the formative power of the Soul, turning life into a problem, exalting the practical-ethical tendencies of an unreligious and unmetaphysical cosmopolitanism. It is veritably a polar winter that settles down upon Spengler's world, and we shall not pursue it through its dreary stages of "materialistic world-view" and "philosophy without mathematics" (!) and "inner completion of the mathematical world of forms" (in Gauss, Cauchy, Riemann), and declining philosophy reclining in "chairs" logical and psychological, and of "ethical Socialism" spreading itself from 1900 on like ice and snow descending from the pole. Such, we are told, is "the End; Expansion of the final cosmic mood"—Buddhism in India (since 500 B. C.), Stoicism in the classic world (since 200 B. C.), Fatalism in Islam (since 1000 A. D.), Socialism in the Occident (since 1900). The spiritual moods that agree in their distinctive features are classified as "contemporary," though thousands of

years apart in time, as the youth and prime and age of Bach might correspond to those of Phidias.

In equally ingenious and impressive fashion has Spengler arranged his second table, of "contemporary" epochs in art, but the Twentieth Century brings the Occidental column only to the "end of music" (Wagner), the "Episode of Impressionism" (Constable, Corot to Manet and Leibl) and the Pre-Raphaelites. Spengler spares us any but a general forecast of the two ages of decrepitude to come.

A Third Table ranges "contemporary" political epochs also side by side in parallel vertical rows. Here we find ourselves again in the first Stadium of "Civilization," the dissolution of nations into the great Fourth Estate, the People, into anorganic cosmopolitan international masses interested in bread-and-butter, under Parliamentarism, from 1800 to 1900, under Socialism and Imperialism from 1900 to 2000, the Stadium of Money, during which economic complexes absorb the form of the State. We are now "isochronous" with Scipio and Marius in Rome (200 to 100 B. C.); what awaits us from 2000 to 2200 will be something akin to the Golden Age of Rome (200 B. C. to 100 A. D., Sulla, Caesar, Tiberius), and in the third Stadium (2200—) something like the Silver Age from Trajan to Aurelius (100 to 300 A. D.), a deepening twilight, brightened by the Evening Star of Marcus Aurelius. For us then, in the present and approaching stages there is little to hope.

It can hardly be denied that these Tables of Isochronism present an imposing aspect and furnish much food for thought. In many cases it is not easy to deny the parallelism claimed, and the interpretations of Religion, Art, Science, Philosophy, in less degree of Politics, are often profound and plausible to a degree. In discussing Number, Space and Time, the significance of the third dimension, in refuting the favorite dogma sanctioned by Kant, and even by Sir William Rowan Hamilton, that number-theory is rooted in the intuition of time, that Algebra is the science of pure time, Spengler appears at his best and his book is an excellent tonic. Hardly less arousing his contrast so often enforced between the ancient and the modern mathematics in relation to the notions of the Infinite and the Irrational. The grave objection seems to be that Spengler holds his parallel but asynchronous cultures in unnatural isolation so that each shall develop independently unaffected by any other, though it seems out of question that the cross-currents of influence have been numerous and important and especially the

classic culture has propagated itself in the occidental and even in the Arabic along countless and interminable lines. It seems strange that such a broad-browed intelligence as Spengler should allow himself, in the interest of a theory, to do the Greek spirit such a sad injustice.

But the most serious fault in the schemes of both Petrie and Spengler is the overweighting of the artistic and intellectual and the underweighting or almost total omission of the moral elements of Culture or Civilization. "Forms of government are left to the last, as the regulation of daily affairs, and the repression of wrong, is of little meaning in civilization, when compared with the great formative interests of man's mind whose phases we have studied." We may agree with Petrie as to the rest, but not as to "the repression of wrong," if this be extended to denote the gradual evolution of the idea of Justice and its realization in the organization of Society and the conduct of Life. We may even contend that this is a matter of supreme "import" as well as "concern." As almost the very last in its appearance in man's history, it seems almost like the sixth day's work of Creation in comparison with its forerunners, whether these be Art or Science or Wealth. That Justice should prevail throughout the land, that Right should reign over all men and over all the world, seems quite as important as that temples and statues should be beautiful, epics majestic, oratorios entrancing, eclipse calculations accurate, and mathematical-philosophic theories profound. Moreover, the metaphysical freightage of the idea of the Just is not inferior to any other; for it implies a single most highly organized consciousness of Each in its identity with All, a Communal Consciousness Divine. If now we try our present day civilization by this standard, we shall find it indeed very far from approvable but very far from hopeless or decadent. In spite of the mounting wave of crime, in spite of numberless wrongs unredressed and injuries unavenged, in spite of inequity everywhere rampant and misery widespread and appalling, in spite of an horizon temporarily lowering all around, it is nevertheless true that the Dignity and Rights of Man are now affirmed more widely and effectively than ever before. From sea to sea, from pole to pole, the urgent and persistent demand for the rectification of age-long inequity is heard, and it awakens echoes in millions on millions of hearts. The "lamentation and the ancient tale of wrong" "steams up" no longer unavailing. We are beholding in fact the travail of humanity in bringing to light the prodigious birth of Socio-economic Justice. To be

sure, the old Dragon waits to devour it—but we do not fear, it will be saved in the Wilderness. Not for an instant would we undervalue or disparage the great formative powers and interests of mind that Petrie and Spengler have glorified in their tabulations. They are much, they are very much, but they are not all. The Himalayan peaks are not the whole mountain range, even the table land and the lowest valleys count in the total, and they must be regarded if we are to understand the whole formation aright. It is easy to deride Democracy and to present a strong case against it; but what better have you to substitute therefor? It is only Man that can save Man, and his salvation is a process of Growth. This growth is slow and often whimsical and even disappointing, but nevertheless it actually takes place, as the schemes of Petrie and especially Spengler abundantly show. Our present civilization has yet two or perhaps four hundred years in which to die. Perhaps in that time America may make herself heard in the choir of cultures. Neither Petrie nor Spengler has yet caught the tone of her voice, for them she has no spiritual significance as yet. Be it so. But Petrie thinks that every culture-wave swells up from a blend of bloods, a mixture eight centuries old, and then rejoices in its energy for five hundred years. Here then we have this alleged primal condition of the culture-producing urge, but clearly we have yet long to wait before the blend is quite complete and yields its maximum of power. However, the process of amalgamation may not wait on precedent, but may quicken its pace in an age of speed, and long before the year 2400 the crest of a culture whose slogan is Justice and whose flying goal is a Communal Consciousness Divine may lift itself on high over all America of the North.

There are many collateral matters in the *Untergang* that deserve and even call for mention, but one seems to be of special importance. It is the attitude of the author with respect to the historical fact of Christianity and its general cultural significance. Of course, we do not look in a History of Civilization for any discussion of critical questions, but we might expect some indication of the place assigned to such a dominant historical phenomenon in the general list of culture-factors, or at least culture-products. Petrie disappoints any such a natural expectation; he has nothing to say on the subject in his small but exceedingly compact and pithy volume. H. G. Wells in his ambitious *Outline* gives a chapter on the "Beginnings of Christianity." His treatment of the Origins is feeble, flighty, sketchy,

without critical warrant, a hotch-pot of errors. For him the Proto-christian movement was a social revolt, its "seed rather than founder" was an unparalleled preacher of righteousness, whose followers believed he had been raised from the dead after judicial crucifixion! To them the scholarly Paul supplied a theology, and they proceeded to convert the world to their semi-communistic doctrine of universal Brotherhood! Of the many impossibilities that confront such an easy-going Naturalism Wells seems to have no inkling. His only answer to objections would seem to be simply to ignore them. Nevertheless, in discussing the Deutero-christianity of the following centuries, he does emphasize with truth and justice the cultural significance of the church in supplying the connective tissue of society, a spiritual center and a moral authority, a guiding thought—the unity of Man—a code of conduct and a theory, however imperfect, of history and the government and destiny of the universe—all matters (as Petrie might say) "of great concern, but little import." One may ask of "little import" to what or whom? And the answer would show that Art and Science and Literature are themselves only Symbols of Man's activity, of his soul-struggle towards realizing his possibilities, and that the age-long will to Justice and the perfect socio-economic organization of humanity is not second in importance to the will to Beauty and even to Truth. In recognizing this cultural service of the medieval church, Mr. Wells has done altogether well.

On turning to Spengler we find that his attitude is highly enlightened on this as on almost all other questions. His classification is indeed different from any other we have examined, but it seems to disclose a far clearer apprehension and profounder penetration of the historical-cultural situation itself. Spengler coördinates the Christian or monotheistic movement (under the name "Arabic") with and between the classic and occidental Cultures, and traces it through all its "contemporary" epochs side by side with the other two. It may be startling to many to find "Urchristentum" in the same column with "Muhammad" and the like, still more to find the Edda, Dante, Thomas Aquinas, Galilei, Luther, Rousseau, Voltaire, Marx, Schopenhauer, Nietzsche, and many other such—all in one happy family, dwelling together like brethren in unity in the great occidental column. But there is the severest logical method in his madness. Spengler has done well to recognize fully the Arabic Culture and its world-significance (as Petrie also in less measure).

We might have done still better to call it Semitic and to assign the Jew his fitting place of honor amid the Makers of the Present as well as the Past. But one sadly suspects even Spengler, magnanimous as he is, of being infected with the anti-Semitism that has scattered its germs from Moscow to Dearborn and beyond. He awards ample credit to the Arab, but the Hebrew and the Jew he rarely mentions and never in terms of just appreciation. Protochristianity (*Urchristentum*) he dates from the year 0 B. C., not unnaturally but yet erroneously, for the movement was in reality prechristian. Simon Magus, the patristic father of heresy, had been preaching the "Great Power of God" in Samaria a "long time" before the death of Stephen in the early dawn of the Christian day, and Hippolytus shows that even he was several steps down in the list of Gnostic heresies. Spengler treats the matter with considerable reserve, in utterances where more is meant than meets the ear. Apparently he regards this "Urchristentum" as the symbol of the early mythopoetic soul, as the "birth of a Myth of the Grand Style, as an expression of a new Sense-of-God" (*Geburt eines Mythus grossen Stils als Ausdruck eines neuen Gottgefühls*),—at least, as such he classifies it side by side with the *Mythologie des Veda* and *Olympischer Mythus*.

The reader may be interested in this paragraph (p. 576): "In the world-historical word, 'Render unto Ceasar what are Caesar's and unto God what is God's,' which is laid on the lips of the Christ of the Gospels, the classic and the Arabic God-consciousness appear in the sharpest antagonism and necessarily in mutual misunderstanding. Any reconciliation of the strictly Euclidean almost posthumous "Divus-cult" (of the deified Caesar) with the primitive (*ganz jungem*) magic-monotheistic Christianity was made impossible by the culture-stadia that both pre-supposed, the first an end, the second a beginning." It seems doubtful whether the term "magic" be justified, but there can be no question about "monotheistic." Only as such a monotheistic crusade is "Urchristentum" intelligible—not at all in Wellsian fashion as a socialistic insurrection—and only as such has it the unsurpassable significance that Spengler's classification with justice assigns it.

Profound and exact in scholarship as our author is, he is not quite inerrant. On page 48 the "Jew-king Herod" should perhaps be Herod Atticus, who built the Odeon at Athens and otherwise beautified the city. In spite of an inflated Josephine question, and

a vague uncertain inscription (No. 550), we do not know of anything King Herod did for Athens. Again, the Law of Least Action was first proposed by Maupertuis, exactly formulated by LaGrange. On page 588 the honor is assigned to D'Alembert, who does not need it, to whom it does not belong. But it is an ungrateful and ungracious task to pick out spots on the sun.

In conclusion, this volume of Spengler's takes a long step forward in the interpretation of human history. Not all his individual judgments will approve themselves, and his final result may have gone far astray. But his whole work is grandly conceived and his philosophic postulates and method, in spite of the most prevalent and passionate contradiction, must win their way to wider and wider and more unreserved acceptance. Spengler has not attained the goal,—by no means! but he has blazed a path that will surely be followed by such as cannot accept a fortuitous concourse of atoms as the ultimate content and meaning of the history of the World.

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A SYNTHETIC LANGUAGE FOR INTERNATIONAL USE

(In English and Ido)

A WELL-KNOWN journalist has said: "The world has always laughed at the things that have come true. In every age there are those who think and those who laugh. When that age has passed, there comes another, and always it is true—there has never been an exception to it—that when the world looks back it builds statues to those who thought and laughs at those who laughed."

Bone konocata jurnalisto dicis: "La mondo sempre ridis pri la kozi qui divenis vera. Dum omna epoko esas ti qui pensas e ti qui ridas. Kande ta ejepoko pasis, altra venas, ed esas sempre vera—nultempe esis excepto—ke kande la mondo regardas retrospektive ol konstruktas statui a ti qui pensis e ridas pri ti qui ridis."

One can easily foresee the renaissance of that glorious time when the learned were able to intercommunicate by means of a language common to all.

On povas facile pre-vidar la ri-nasko di ta glorioza tempo kande l'eruditii povis interkomunikar per linguo komuna ad omni.

The League of Nations and many scientific societies and other organizations are considering the problem seriously and officially.

La Ligo dil Nacioni e multa ciencala societi ed altra organizuri konsideras la problemo serioze ed oficale.

Professor Gilbert Murray, vice-chairman of the executive committee of the League of Nations, said that the necessity of an international language was forcibly borne upon him when attending the meetings of the League-Council at Geneva. He added that Ido was easier than Esperanto for most Europeans.

Profesoro Gilbert Murray, vice-prezidanto dil exekutiva komitato di la Ligo dil Nacioni, dicis, ke la neceseso di ula internaciona linguo forte impresis il, kande il asistis la kunveni di la konsilantaro di la Ligo en Geneve. Il adjuntis, ke Ido esas plu facila kam Esperanto por la maxim multa Europani.

The common language of the future will not be, cannot be, the Latin of antiquity, nor the Latin of Newton and Halley or the other philosophers and mathematicians of their epoch.

La komuna linguo di la futuro ne esos, ne povas esar, la Latina antiqua, nek la Latina di Newton e Halley e l'altra filozofi e matematikisti di lia epoko.

Furthermore, the common language of the future will not be, cannot be, restricted to the learned or even to "intellectuals" in any sense whatever.

Pluse, la komuna linguo di la futuro ne esos, ne povas esar, restriktata a l'eruditio mem a l'inteligenta personi, en irga senco.

The world moves, customs change, civilization becomes modified, and the ordinary man seeks self-expression, in person. He trusts no longer, or not exclusively, to his guides. He insists that he have the right and the chance to speak for himself.

La mondo movas, kustum chanjas, civilizado divenas modifikit, e l'ordinara homo serchas su-expreseso, persone. Lu ne fidas pluse o ne exkluzive, a sua guideri. Lu insistas, ke lu havez ia yuro e la chanco por porolar por su ipsa.

Therefore, it is evident that the common language of the future ought to be able to respond to the requirements of the educated and the uneducated world.

Do esas evidenta, ke la komuna linguo di la futuro devas povar respondor a la postuli di l'erudita e la ne-erudita mondo.

But the Latinists have nothing to fear. They certainly would not wish to see the mutilation of Latin as such.

Ma la Latinisti ne bezonas timar. Li certe ne volus vidar la mutilado di la Latina kom tala.

Consequently, the true solution of the whole problem is in some form of Neo-Latin.

Konseque, la vera solvo di la tota problemo esas en ula formo Neo-Latina.

The world requires a common language which is founded upon the scientific principle of maximum internationality as governed by regularity and facility.

La mondo postulas komuna linguo qua esas fondita sur la sciencala principio di maxima internacioneso segun regulozeso e komodeso.

Of course, such a language should be as nearly "natural" and "readable at first sight," as possible, without the loss of regularity, precision and facility. These qualities are much more important than "naturalness."

Komprenende, tala linguo devas esar maxim "natural" e "lektebla ye l'unesma vido," posible, sen perdar regulozeso, precizeso e komodeso. Ica qualesi esas multe plu importanta kam "naturaleso."

The supporters of the idea of an "invented language" seem to be divided into two groups:

- (a) Those who opine, that in order of importance the desiderata are: (1) regularity, (2) precision, (3) naturalness.
- (b) Those who opine, that in order of importance, the desiderata are: (1) naturalness, (2) regularity, (3) precision.

L'adheranti di l'ideo di ula "inventita linguo" semblas esar dividita en du grupi:

- (a) Ti qui opinonas ke, segun ordino di importanteso, la dezirindaji esas: (1) regulozeso, (2) precizeso, (3) naturaleso.
- (b) Ti qui opinonas ke, segun ordino di importanteso, la dezirindaji esas: (1) naturaleso, (2) regulozeso, (3) precizeso.

Ido is very regular and precise and seems to be sufficiently natural.

Ido esas tre reguliza e preciza, e semblas esar suficiente naturala

Professor A. L. Guerard says that in point of immediate intelligibility, Ido could almost compare with the purely Neo-Latin schemes—Neutral, Panroman and Latino.¹

Profesoro A. L. Guerard dicas ke, del vid-punto di quika komprenebleso, Ido povus preske kompareesar kun la pure Neo-Latina sistemi—Neutral, Panroman e Latino.

The purely Neo-Latin schemes, for example, Latino sine flexione, Inter-lingua, are too natural and irregular. Such a language is easy to read but difficult to write or to speak.

La pure Neo-Latina sistemi, exemple Latino sine flexione, Inter-lingua, esas tro natural e ne-reguloza. Tala linguo esas facile lektebla, ma desfacile skribebla o parolebla.

¹ *A Short History of the International Language Movement*, A. L. Guerard, page 155; London, 1922.

Among other projects are Romanal and Occidental which are very natural but not so regular as Ido.

Inter altra projeti esas Romanal ed Occidental qui esas tre naturala, ma ne esas tam reguloza kam Ido.

Guerard declares that "the sound of Esperanto-Ido is more pleasing than that of Romanal."²

Guerard deklaras ke "la sono di Esperanto-Ido esas plu plezanta kam ta di Romanal."

A writer in the London *Times* says that Ido in appearance and sound is more attractive than Esperanto.³

Skribanto en la London *Times* dicas, ke Ido relate aparo e sono esas plu atraktiva kam Esperanto.

Other impartial critics say that "between Esperanto and Ido, the latter seems to be preferable."⁴

Altra senpartisa kritikanti dicas, ke "kompare Esperanto ed Ido, Ido semblas esar preferebela."

Brander Matthews acknowledges the "undeniable merits" of Ido.⁵

Brander Matthews agnoskas la "nerefutebla meriti" di Ido.

Guerard says that the final solution seems to lie between the dialect of Zamenhof (Esperanto), too hybrid and arbitrary, and that of Peano (Latino, Inter-lingua), too irregular in its "naturalness": more precisely, between Ido and Romanal.⁶

Guerard dicas, ke la finala solvo semblas restar inter la dialekto di Zamenhof (Esperanto), tro mixita ed arbitrala, e ta di Peano (Latino, Inter-lingua), tro ne-reguloza pro olua "naturaleso"; plu precize, inter Ido e Romanal.

² *Ibid.*, page 235.

³ Quoted in *Science* (U. S.), Vol. LV., No. 1426, April 28, 1922, page 458.

⁴ *The American Journal of Pharmacy*, June, 1922, published by the Philadelphia College of Pharmacy and Science, 145 North Tenth Street, Philadelphia.

⁵ *Essays on English*, Brander Matthews, page 277.

⁶ *A Short History of the International Language Movement*, A. L. Guerard, page 193; London, 1922.

Dr. F. G. Donnan, F. R. S., professor in the University of London, said, in a discourse before the Royal Institution, that if the final selection were to be either Esperanto or Ido, he would prefer Ido, but he predicted that the ultimate solution would be some form of Neo-Latin similar to Romanal, with various modifications to secure regularity and precision.⁷

Doktoro F. G. Donnan, F. R. S., profesoro en l'universitato di London, dicis, en diskurso koram la Rejal Institucuro, ke, se la finala selekto esos sive Esperanto sive Ido, il preferos Ido, ma il predicis ke la definitiva solvo esos ula formo Neo-latina, simila a Romanal, kun diversa modifikasi por obtenar regulozeso e precizeso.

One of the most charming of the recent contributions to the discussion of the subject is an article on "Babel and Geneva," by Prof. A. L. Guerard, published in *The Texas Review*.

Un de la maxim atraktiva di la recenta kontributi a la diskuto di la temo, esas artiklo "Babel e Geneve," da prof. A. L. Guerard, editita en "*The Texas Review*."

There exists a large collection of books in Ido. Among them is a pamphlet entitled, "The Notion of Time," by Bergson, translated from the original French text into Ido by Paulo Dienes, doctor of mathematical sciences at the Sorbonne. The Ido text, published at Buda-Pest, is perfectly clear, although the subject is philosophical and sufficiently difficult.

Existas granda kolekto di libri en Ido. Inter oli esas broshuro titulizita "La Nociono di la Tempo," da Bergson, tradukita de l'originala Franca texto aden Ido, da Paulo Dienes, doktoro di la matematikala cienci, de la Sorbonne. L'Ido texto, editita en Buda-Pest, esas perfekte klara, quankam la temo esas filozofiala e pasable desfacila.

It is evident that the world should not be required to adopt, even provisionally, any international language which is not so good as Ido.

Esas evidenta, ke on ne devez postular, ke la mondo adoptez, mem provizore, ul internaciona linguo qua ne esas tam bona kam Ido.

⁷*Auxiliary Languages*, F. G. Donnan, in *Nature* (London), April 15, 1922, pp. 491-495. To be reprinted in the *Proceedings* of the Royal Institution.

The gift of a common language to the peoples of the world would be exceedingly useful to them in all international relations. Let us hope that a greater number of philologists and linguists will interest themselves in the problem.

La donaco di ula komuna linguo a la populi di la mondo esus tre utila a li, en omna internaciona relati. Ni esperez ke plu granda nombro di filologi e linguisti interesos su pri la problemo.

EUGENE F. MCPIKE.

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Note.—Information concerning Ido is obtainable from The International Language (Ido) Society of Great Britain, 57 Limes Grove, Lewisham, London, S. E., England, and from The American Ido Society, 7616 Tioga Street, Pittsburgh, Pennsylvania, U. S. A.

NEW ALTARS.

BY ETHEL TALBOT SCHEFFAUER.

She with her iron hands
To whom the peoples bowed,
Throned above all the lands,
Once called aloud:

Bring unto me the young men,
With flowers and with mirth,
Bold songs shall be sung then
In all the earth.

Honor and fame will I buy them,
They that are young and brave,
After, I will deny them
Even a grave.

They shall be flung like rain
Over the wailing ground—
None of these many slain
Shall more be found.

And men came to her altars,
Young men and old,
And women with fiery psalters
And flowers and gold.

Fools, caught by her wonder,
Throning over the lands,
Saw not her claws of plunder,
Nor her iron hands.

The blood-wave heavy and tidal,
 Swept over many a race.
 Would it had taken the Idol
 And rolled her from her place!

That the repentant nations,
 Slowly, each one alone,
 Might seek in forgotten patience,
 Stone by stone.

Slabs for the new altar
 Where the new god shall reign,
 Before whom the old gods falter,
 Hallowing his fane.

Whose words are pity and sorrow,
 Whose words can build
 The temple of to-morrow
 For freedom's guild.

With no mistrust of a neighbor,
 Nor hate, nor envy, nor fear—
 A white altar of labor,
 A gold altar of cheer—

An altar of freedom and peace,
 Glowing out of the sand,
 And bidding the tumults cease
 In every land.

This is the new fane,
 With tears of longing wet—
 But the peoples hope in vain,
 For none is building yet.

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BOOK REVIEWS AND NOTES

THE MANHOOD OF HUMANITY: THE SCIENCE AND ART OF HUMAN ENGINEERING. By Alfred Korzybski. E. P. Dutton & Co., 1921. Price, \$3.00.

"In the name of all you hold dear, you must read this book; and then you must re-read it, and after that read it again and again, for it is not brewed in the vat of the soft best-sellers to be gulped down and forgotten, but it is hewn out of the granite, for the building of new eras."

It must not be supposed that those powerful words are an irresponsible utterance of an excited enthusiast. Far from it. They were written by no less a person than Mr. H. L. Haywood, the sober-minded editor of *The Builder*, and may be found in the August number of that official organ of The National Masonic Research Society.

Indeed Haywood's estimate of the book does but confirm the judgment of many other competent critics including educators, engineers, logicians, mathematicians, biologists, psychologists, political philosophers, publicists, and other thinkers.

Let us hear a word from some of them.

"It is," writes Alleyne Ireland, "a contribution of the highest importance to the study of every problem in which human life is one of the factors."

In *The Freeman*, Ordway Tead says: "It is a forthright, earnest book by one who has seen a vision and would share it with his fellows."

Dr. Eric T. Bell, an eminent mathematician, says that "it took a genuine flight of genius" to make "Korzybski's main discovery that plants, animals and men are respectively energy-binders, space-binders, and time-binders." And Dr. Bell adds that "Anyone but a congenital idiot will get out of this book as much entertainment of a lasting kind as is contained in a whole library of romance."

"I consider Count Korzybski's discovery of man's place in the great life movement," writes Robert B. Wolf, Vice-president of the American Society of Mechanical Engineers, "as even more epoch-making than Newton's discovery of the law of gravitation."

Writing in *The Journal of Applied Psychology*, Max Meenes states that "The Manhood of Humanity is a truly remarkable contribution toward a scientific study of humanity and should command the attention of all interested in humanity's problems."

Dr. Petrunkevitch, Professor of Zoology at Yale, thinks its "main principles are so important that the book should be carefully studied by all men of science."

Dr. L. O. Howard, eminent entomologist, in his presidential address at the annual meeting of the American Association for the Advancement of Science, Toronto, 1921, said: "Count Korzybski in his remarkable book, *Manhood of Humanity*, gives a new definition of man, . . . and concludes that humanity is set apart from other things that exist on this globe by its time-binding faculty, or power, or capacity." Dr. Howard adds: "It is, indeed, this *time-binding* capacity which is the principal asset of humanity."

And Dr. Walter N. Polakov, well-known engineering counselor and distinguished author of *Mastering Power Production*, says: Korzybski's book "is bound to become our new Organum, interpreting Humanity to itself, and ushering in a new epoch."

It would be easy to swell the chorus of similar testimony to vast proportions, for abundant material is at hand, but it would be superfluous to do so. What has been submitted is enough to arrest the attention of even the dullest minds. For it is perfectly evident that a book that calls forth such words from such men, representing as they do almost every great field of scientific scholarship, is a book that you and I must read, and re-read till we understand, if we are not to be dumbly ignorant of the most helpful and hopeful thought of our troubled time.

Lest any one reading these words might suspect that my own estimate of the book is but an echo of the opinions above quoted, I may be permitted to say that more than a year ago and shortly after the book came from the press I wrote as follows in *The New York Evening Post*: "We have here a book that is worthy of the times. Physically it is not large, but spiritually it is great and mighty—great in its enterprise, in its achievement, in the implications of its central thought, and mighty in its significance for the future welfare of men, women and children everywhere throughout the world."

What, pray, is that enterprise? What does the book aim at? It aims at turning the world's thought towards establishing the greatest of all conceivable things—the science and art of *human engineering*—the science and art of an engineering statesmanship magnanimous enough to embrace the entire world.

But what, pray, is human engineering? Human engineering—engineering statesmanship—is to be the science and art of coordinating the civilizing energies of the world and directing them to the advancement of the welfare of all mankind including posterity. Nothing conceivable could be nobler than that. In that great good are embraced all possible goods.

We are at once confronted with a great question. What is the science and art of human engineering to be *based* upon? It goes without saying that the basis must be a scientific basis—some kind of scientific knowledge. And the question is: scientific knowledge of *what?* The answer is: scientific knowledge of human nature—scientific understanding of the essential nature of Man.

Here we encounter the most important question that can be asked: What is Man? What is that quality or capacity in virtue of which human beings are *human*? What is the *distinctive* place of mankind in the hierarchy of the world's life?

In connection with that question Korzybski has rendered the world an immeasurable service. He has indeed propounded the question to himself but that is not what I mean. He has made it perfectly plain that the question is

at once supreme and fundamental but neither is that what I mean. What I mean is that he has given the great question the *best* answer it has received in the history of thought—an answer which, because it is true, is infinitely superior to all its rivals. What is the answer? It is an answer defining our humankind in terms of Man's peculiar relation to what we call *Time*. The words are these (p. 60): "Humanity is the time-binding class of life."

What do the words mean? It is evident that the burden of the meaning is borne by the term *Time-binding*. For the significance of this really mighty term the reader must be referred to the book itself where, says the mathematician and poet, Professor Bell, "the ideas are stated with such admirable clearness in so many different and illuminating ways that any person of average intelligence can grasp the essential meaning at one reading." Should any one desire to examine my own attempt to lay bare in a few words the great term's central nerve, I may refer him to pages 428-431 of my *Mathematical Philosophy* where I have dealt with Korzybski's conception of man in the light of modern advances in logical theory.

Just as soon as readers grasp the meaning of the term *time-binding* and come thus to understand the author's concept of Humanity, then and not before they will understand both why he denies the ages-old mythical idea that humans are hybrids of natural and supernatural and why he also denies and denounces the zoological conception that humans are a *species of animals*.

It is instructive to compare the logic of Korzybski's great work with that of Professor Robinson's interesting book, *The Mind in the Making*. The aim of the authors is the same—the welfare of mankind. They are both of them evolutionists. They both believe that man is sprung from Simian stock. Korzybski nevertheless maintained that humans are not animals for animals, says he, are merely *space*-binders while man is a *time*-binder. Robinson, on the other hand, contends that humans are animals and endeavors again and again to rub that belief indelibly into the minds of his readers. Why do such thinkers as Robinson regard man as a species of animal? Is it because man has been evolved out of animal ancestry? If *A* has been evolved from *B*, do they really think that *A* is therefore necessarily a species of *B*? If heat be applied to ice there is evolved first water and then steam. Is steam to be rightly regarded as a species of ice? Man has been evolved from Simian mammals, mammals from reptiles, reptiles from fishes, and these probably, through a long course, from "microscopic globules of living matter, not unlike the simplest bacteria of today." Are thinkers like Professor Robinson prepared to follow their own "logic" and say that our humankind may be helpfully regarded as a species of ape, as a species of reptile, as a species of fish, as a species of ancient microscopic globule of living matter, not unlike the simplest bacteria of today? If it should be discovered in Professor Robinson's time that the organic and the living have been evolved from the non-living and inorganic, would the learned historian then argue that the living is a species of the non-living and that the organic is a species of the inorganic? The evolution of the *Novel* is an indubitable fact but it is a ridiculous contention that whatever is new must be a species of all the things from which it has sprung.

Is it contended that humans are species of animal *because* humans have certain animals organs, functions, and propensities? One would be not less

foolish to contend that animals are plants because they have many organs and functions that plants have or to contend that solids are surfaces because solids have some properties that surfaces have or to contend that fractions are whole numbers because they have some properties that whole numbers have.

The philosophy of many a historian and many a zoologist would be greatly improved by a solid course in freshman logic.

Korzybski's concept of Man is the core of his book and the organic center of his philosophy. If you will master that concept you will find that it is related to the other ideas in the work as the sun is related to the planets and planetoids of our solar system. And as you continue your meditation you will discover much more.

If you are a historian you will find that the new concept of man demands a new philosophy of history—a philosophy that shall study the evil rôles which false concepts of human nature have played from time immemorial.

If you are a student of ethics, you will find that the new concept affords a scientific basis for a moral system infinitely superior alike to the ethics of magic and myth and to the zoological ethics of the righeousness of might—the ethics of tooth and claw, competition, combat, and war.

If you are an educator you will find that the highest obligation of home, school, and press is to teach boys and girls and men and women everywhere to understand and to feel what they as humans really are—not animals nor hybrids of angel and beast but time-binders, civilizers, inheritors of the achievements of the dead, charged to use the inheritance justly and to transmit it with increase to he yet unborn.

If you are an engineer—and we are all of us engineers in some respect—you will find that Korzybski's conception of man is the solid basis for that science and art of *human* engineering—that science and art of engineering statesmanship—whose function it is to study the time-binding energies of the world, the civilization-producing energies of our kind, to coordinate them and to direct them to the welfare of all mankind including posterity.

I will close by repeating what I said elsewhere. "Not to read this book is to miss the best thought of these troubled years."

CASSIUS J. KEYSER.

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